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THE HEATING AND VENTILATING MAGAZINE

Vol. XI. No. 10
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NEW YORK, OCTOBER, 1914

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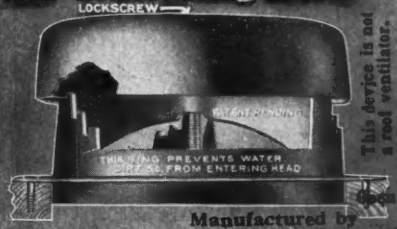

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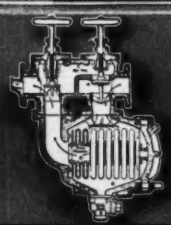

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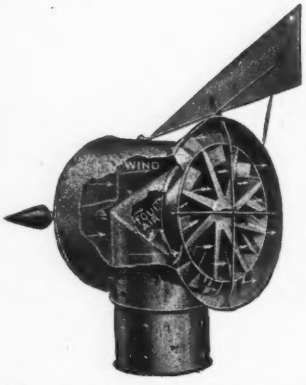

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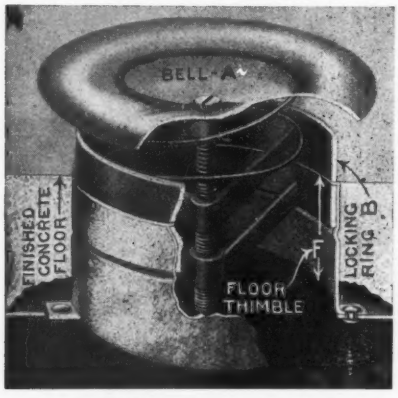

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THE HEATING AND VENTILATING MAGAZINE

1123 BROADWAY NEW YORK OCTOBER, 1914

FIG. 1.—ST. ELIZABETH HOSPITAL, COVINGTON, KY.

An Extensive Open-Tank Gravity Hot Water Heating System

INTERESTING FEATURES OF AN INSTALLATION CONTAINING 36,000 SQ. FT. OF RADIATION.

By GEORGE STUMPF, JR.

It is the purpose of this article to review some of the difficulties met with in the engineering and designing of probably the most extensive *open-tank gravity hot water heating system* in the country, which operates as one complete unit.

The plant, as designed by the writer, was installed in the St. Elizabeth Hospital Building, Covington, Ky., and is now in successful operation. S. Hannaford & Sons were the architects, and the General Fire Extinguisher Company was the engineer and contractor.

The hospital consists of five buildings, forming a rather compact group, all interconnected, and with a power house at one extreme end, as shown on block plan herewith.

The main building consists of four floors and a basement; the convent building, and the children's building, each of three floors and basement; the chapel building, laundry and stable building, of one or two floors and basement, all heated throughout.

The apparatus has a total of 36,000 sq. ft. of heating surface contained in about 550 units of direct radiation. All of this radiation is handled by four "B" heat intensifiers, made by the National Steam Specialty Company. Pressed steel radiators of the hospital type were installed.

The boiler plant consists of three 60-in. diameter by 16 ft. long horizontal tubular boilers, full of tubes, and an extra boiler of same size which can be used for either emergency hot-water

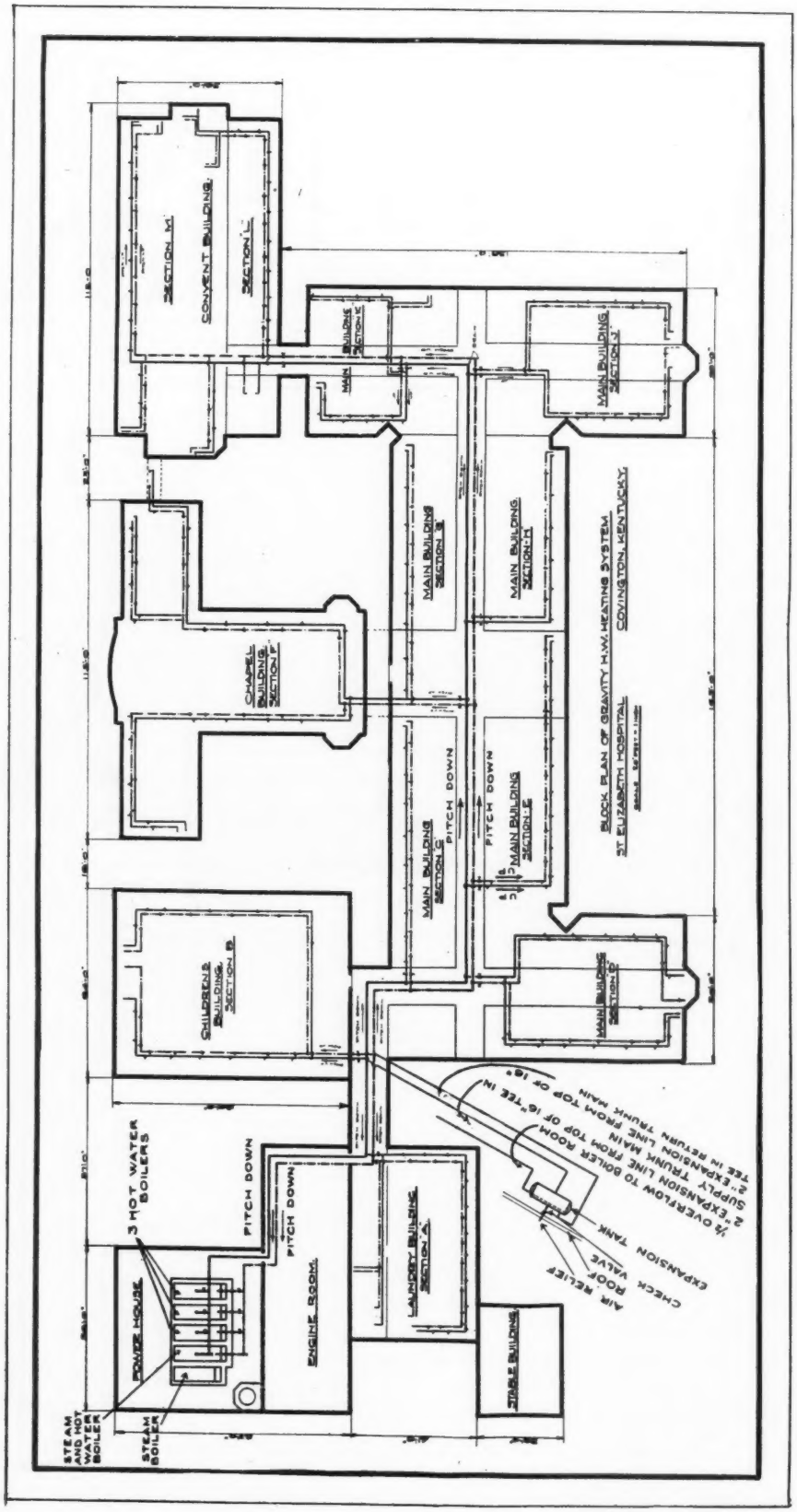

FIG. 2.—BLOCK PLAN OF GRAVITY HOT WATER HEATING SYSTEM FOR THE ST. ELIZABETH HOSPITAL, COVINGTON, KY.

heating or low pressure steam service for hospital fixtures. Also one 60-in. diameter by 14 ft. boiler for continuous steam service for hospital fixtures, etc.

The main supply and return headers and trunk mains are of 16-in. O. D. pipe; with 12-in. boiler connections.

WHY A GRAVITY HOT WATER HEATING SYSTEM WAS CHOSEN.

The principal reasons are as follows:

1. The owners desired the benefits of the variable temperature of water as a heating medium.

2. The owners preferred a system that required as little attention as possible, and that would leave the regulation of temperatures to the fireman stationed in the boiler room.

3. The owners also wished to reduce the operating expenses to a minimum, which referred to the cost of operation of an electrically-driven centrifugal pump proposed in the design of a forced circulation hot-water system.

Figures showing relative cost of installation and operation are as follows:

The cost of the piping system, including fittings, hangers, valves and labor complete for the gravity job was about 2 1-5 times the cost of the piping material and labor complete for the hot water forced circulation installation as proposed previous to the awarding of the contract.

Deducting the cost of two centrifugal pumps with their direct-connected motors (7½ H.P. each) we have the actual excess cost of the gravity system above the forced circulation system—in the sum of $6,800.

Figuring the actual power consumed by one motor as 5 H. P. or 4 K. W. per hour, at the rate of 6 cents per K. W. hour would be $0.24 per hour—running 24 hours per day for six months equal $1,036, as the cost of the power for driving one pump for the heating season. Making an allowance for loss of investment, etc., it would be true that in seven or eight years of service the extra cost of the gravity system would be offset by the cost of operation of the pump, and that thereafter the forced circulation system would show up a fixed power charge of over $1,000 per year, while the gravity system would have no such item of operating expense. Eventually the pumps and motors of the forced circulation system would require overhauling, repairs, or perhaps renewal, all of which expense would never occur in a gravity system. In other words, a gravity system is an economical investment even on a large scale, if the plant is to be kept in operation for ten or more years. In a building such as this hospital, it is unquestionable that the system will be in service fifty years hence.

FIG. 3.—ST. ELIZABETH HOSPITAL, LOOKING FROM CONVENT BUILDING.

4. The power house which was designed for high pressure water tube boilers in connection with a future electric generating plant was partially completed when the decision was reached to aban-

don the installation of the power boilers —Therefore, instead of using a separate gravity hot water system for each building it was considered more desirable to use the power house for the central hot water boiler plant, and to install one complete system for heating all of the buildings.

ECONOMICAL LIMIT IN SIZE OF A GRAVITY HOT WATER HEATING SYSTEM.

Before going into the details of construction and design let us first become familiar with the relative elevations of the boilers, and the basement ceiling radiators. The center line of the horizontal tubular boilers is at elevation 484 ft. 6 in., the center line of all basement ceiling radiators is at elevation 502 ft. 10 in.; the available height of circulation is therefore 18 ft. 4 in. The total drop in temperature of the water passing through the radiators and the height of the various radiators above the center line of the boilers. The writer believes that the practical limit of travel for the water (1700 ft. total) has been reached in this system for the available head (18 ft. 4 in.), and that it would be inadvisable to design a gravity hot water heating system in which the horizontal length of circuit through the last radiator, expressed in lineal feet, is more than one hundred times the distance in feet that this last radiator is above the center line of the boiler. We have assumed, of course, that the system be required to operate under conditions of a reasonable response to desired changes in temperature of the water, as demanded by varying outside temperatures.

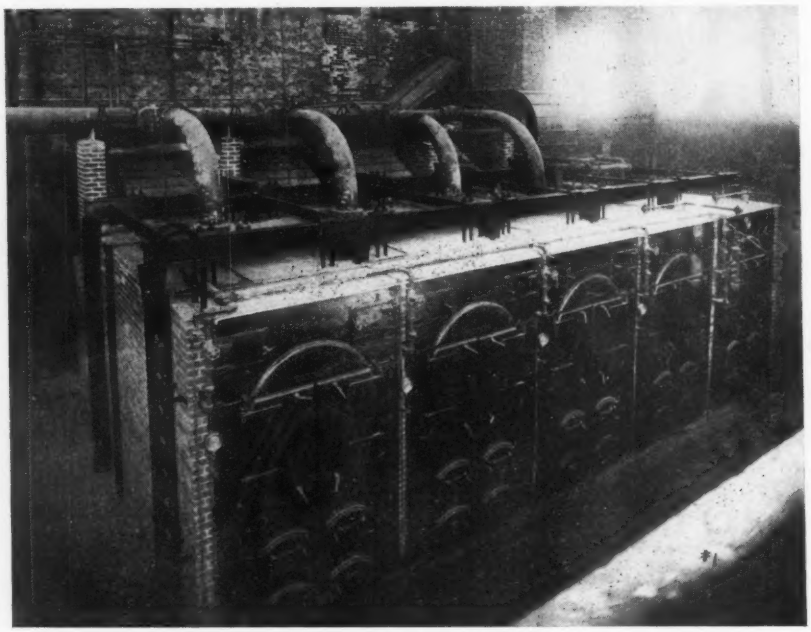

FIG. 4.—BOILER ROOM, ST. ELIZABETH HOSPITAL.

length of circuit from the boiler outlets to the basement radiator in the convent building is about 825 ft. for the supply piping, and about 850 ft. for the return piping, making a total travel for the circulating water of about 1700 ft., which includes allowances made for fittings, etc.

Of course it is known that there is only a definite amount of head available for circulating the water, dependent on the

HEAT LOSSES.

The heat losses through walls, windows, etc., of the buildings were figured in the usual way, but the volume of the rooms was entirely disregarded. However, the air leakage through a 1-32-in. opening around all windows and doors was figured and the heat units required to heat this air was added to the building transmission losses. To this total were added the usual percentages for

FIG. 5.—RETURN HEADERS AND CONNECTIONS TO BOILERS, ST. ELIZABETH HOSPITAL.

north, west, east and south exposures. It is the writer's opinion that this air leakage method is more nearly correct for obtaining the quantity of air to be heated in a given room than the usual method of determining the air change by the volume of air contained in the room.

It is an established fact that a room heated to a higher temperature than the outside, and communicating with the atmosphere by means of the air leakage through building materials, window frames, etc., has a neutral zone or level where the pressure outside and inside are neutralized. Above this neutral zone the pressure will be from the inside toward the outside, while below the neutral zone the pressure will be from the outside toward the inside.

A few experiments were made by the writer to locate this neutral zone—in a certain room when outside temperature was zero, inside 70° F., and practically no wind blowing. It was found to be located at a level at about half the height of the window.

It is the intention to make more extensive tests to locate this neutral zone, in order to determine more accurately the allowances to be made for various wind exposures.

Of course to heat rooms with different wind exposures to exactly the same degree, the neutral zone of each room will be at the same level, although the relative amount of heat may not be the same. More accurate knowledge on this subject will do away with the uncertainties of increasing the figured heat losses by a certain percentage.

DESIGN OF PIPING SYSTEM.

The design and proportioning of the piping system required the greatest of care in order to obtain perfect circulation in all radiators and in order to make the system respond to changes in temperature within a reasonable amount of time.

The following requirements were set forth by the writer to govern the design of the piping system before the engineering plans were started in order to secure perfect operation.

Requirement 1. That each and every radiator, whether located in near or far buildings, or whether located in basement or top floor, circulate thoroughly and uniformly at a temperature of about 100° F. as well as at 200° F. in the supply main.

The piping system throughout was designed so that the available gravity working head would balance the frictional resistances in the circuit. This gave no near radiator an advantage over any far radiator because the drop in temperature of the water passing through all radiators would be the same.

This drop in temperature was chosen as high as possible in order to keep the pipe sizes within reasonable limits but still low enough to allow the system to circulate thoroughly at the low temperature.

Requirement 2. That all rooms be heated to 70° F. in zero weather.

As all branch mains, risers and radiator connections were exposed and uncovered, the loss in temperature of the water before entering the radiators had to be found before determining the sizes of the radiators. This loss in temperature of the supply water diminished considerably the available circulation head, and the efficiency of the radiators, all depending on the length of travel of the water before reaching the radiators.

In order to determine these losses it was necessary to first calculate, to within 10% of accuracy, the pipe sizes for the whole system. From this the tempera-

ture losses were figured very carefully in order to obtain the exact efficiency of all of the radiators.

It was found that the temperature drop, for instance of Section "J," from the outlet in trunk main to the last basement radiator was 3°. From the outlet in the branch main of Section "J" through any riser and to the first floor radiator was 2°. To the second floor was 2° more, to the third floor 2°, and to the fourth floor 2° more. This drop in temperature was assumed to be the same for all the radiators on the particular floor for the whole section. This calculation after completion showed decrease in efficiency of 15% for the radiators on the top floor of the last building (convent). This loss in efficiency, if neglected, would have been sufficient to cause the heating system to be a complete failure, because the rooms in the near buildings would have been heated to a considerably higher temperature than the rooms in the far buildings. The circulation might still have been perfect and uniform throughout, but the heating results would not have been in conformance with the guarantee.

This first approximation of sizes therefore gives all the required information for proceeding with the accurate sizing of the radiators and the whole piping system in detail—subject to requirement No. 3.

Requirement 3. That no valve in the entire system be permitted to be throttled, perfect circulation to be obtained by proper design.

This condition was not stipulated in the contract but was voluntarily assumed by the writer before designing the system.

Uniform circulation to be obtained by designing the piping of such size as to balance the frictional resistances to within 1½ per cent. Wherever the piping could not be installed according to the engineer's details, the pipe sizes were to be changed to obtain the proper equalization of resistances. More equal circulation can be obtained in an extensive system by absolutely correct pipe sizes than by any amount of adjustment of valves.

Supplementing the first calculation of pipe sizes made as demanded by Requirement No. 2, another complete calculation was made with the revised sizes of radiators and the reduced circulation head available,—this gave approximate sizes which might have been suitable for a small job and usual conditions, but which would not have been sufficiently accurate to meet this requirement. Therefore, a third detailed calculation was made which completely balanced all of the available head and entirely eliminated the dangers of unequal circulation due to short-circuits. It also eliminated any possibility of being compelled to adjust valves, an operation that takes considerable time after the system is completed, and which can never be permanent owing to the necessity of repacking and repairing, and to the impossibility of preventing interference with the adjustments.

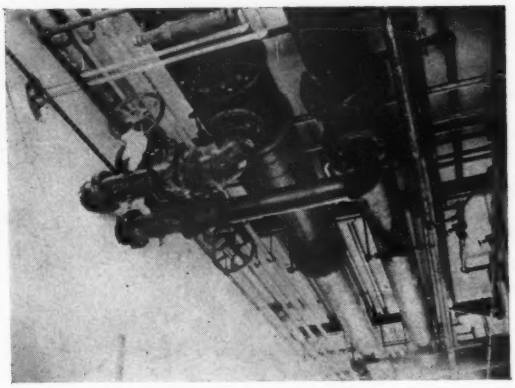

FIG. 6.—TRUNK MAIN TEES AT SECTION B, WITH BRANCH MAINS TAKEN OFF AT BOTTOM.

Requirement 4. That radiators located in distant buildings begin to circulate at about the same time as those located in near buildings; or, when the system is in circulation, that any changes in temperature of the water can be obtained throughout all of the radiators within a reasonable time.

This requirement was the most difficult of all to comply with. It was, however, successfully eliminated by choosing the levels at which the various branch mains were to leave both the supply and return trunk mains. As noted from the plot plan, all of the supply and return branch mains of Section "A," "B," "C," "D," "E," "F," "H" were taken out of the *bottom* of the trunk mains in the corridor. The branch mains of the last wings of the main building, Sections "J"

and "K" and Section "L" of the convent building were taken out of the top of the trunk mains, while the most disadvantageously located branch main of the whole system (Section "M") was made to be continuous with the flow of water in the trunk main—gradually pitching up from elbow at Section "J."

The trunk main tee at Section "B" on both supply and return trunk main are at the same level and are the high points of the whole basement piping, therefore, mains at an angle of 45°, using however, full size trunk main tees with companion flanges on the outlets, eccentric at the bottom and of a size to accommodate the mains of these sections. In a similar manner, by arranging the outlets, the levels of the mains of Sections "E," "F" and "H" were gradually raised.

At section "J" the trunk mains were low enough to permit the branch mains of this and the succeeding sections to be taken out of the top of the trunk mains

FIG. 7.—TRUNK MAINS AT SECTIONS C AND D, SHOWING MANNER OF TAKING OFF BRANCHES.

to bring the branch mains of Section "A" and Section "B" at proper level they were taken off the bottom of the trunk mains with 90° elbow (Fig. 6). From Section "B" (the high point) the supply and return trunk mains pitch down toward the far end of the building 1 in. in every 10 ft. Therefore at Section "C" and "D" (Fig. 7) the trunk mains were slightly lower, and in order to raise the branch mains of these sections slightly above the level of the mains of Section "B," they were taken out from the trunk (Fig. 8) and these branch mains are, therefore, located at considerably higher levels than those of the near sections.

In other words, the near sections are supplied with the cooler water from the bottom of the trunk mains, while the last and furthest sections are supplied with the warmer water from the top of the trunk main. This arrangement of levels of the branch mains results in a more speedy response to changes in temperature of the water in the far sections, and overcomes the natural disadvantage

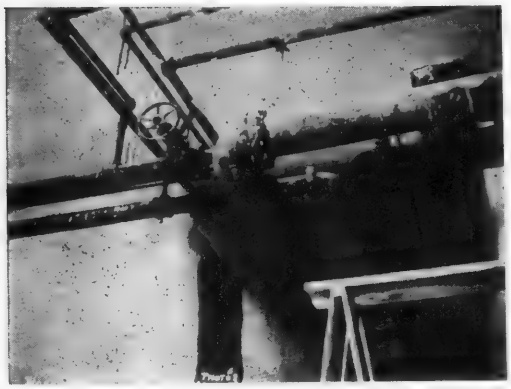

FIG. 8.—BRANCH MAINS TAKEN OUT OF TOP OF TRUNK MAINS AT SECTION J.

of the usual sluggish response in large systems, due to the time required by the water in travelling the length of the horizontal trunk mains before reaching the heating surfaces.

The return trunk main was hung throughout at the same level as the supply trunk main, and all branch outlets taken out exactly the same as those in the supply trunk main. The return branches were taken out of the bottom of the trunk main to prevent a possible backward circulation through any part of the system. Operating conditions might require several sections to have only a few radiators in circulation and, therefore, the water from these sections would return into the trunk main at a considerably higher temperature than that of a neighboring section (which operates under full load). The resulting warmer water at the top of the return trunk main would have had a great retarding effect on the circulation of the neighboring section (full load), if all the return branch mains had been connected to the top of the trunk main. This condition, of course, would only be considered in large installations where the piping is of considerable size.

If these precautions had not been taken, and the system installed along the usual lines, the near radiators would have circulated before even the hot water had reached the end of the trunk main.

Requirement 5. That the system, when once filled to the proper level in the expansion tank, shall not require the venting of radiators.

It is well known that water contains a certain amount of air, and that when the water is heated the air is liberated in the form of small bubbles, which slowly rise to the surface. Therefore, if a system be designed, which provides a high point in the supply header leading from the boilers, and from which a connection is taken direct to the open expansion tank, no air will ever accumulate in any part of the system after it is once filled and vented, provided the expansion tank is sufficiently large to contain the increased volume of water caused by expansion.

This requirement worked out in perfect harmony with the other requirements, by locating the "high-points" of the trunk mains at the top of the tees for Section "B." These outlets were connected to the expansion tank by individual pipes, as shown on the block plan, in order to prevent a short-circuit through the tank from the supply to the return trunk mains. This method of providing a relief for the air has been tried out in several previous installations of considerable size and was found to be perfectly satisfactory. After the system has been in operation for several weeks and all air, which may have been pocketed in the top of the fittings or in the irregularities of the inside surface of the piping, etc., has been relieved, there will be no more accumulation of air in the radiators. This continual necessity of relieving air from

FIG. 9.—CONNECTIONS TO TYPICAL BASEMENT RADIATOR HUNG FROM CEILING, ST. ELIZABETH HOSPITAL.

the radiators at certain intervals, as required when the mains pitch up from the boilers to the last radiator, is a nuisance in any large installation.

Fig. 9 shows the connections to a typical basement radiator hung from the ceiling. It will be noted that the supply connection for the radiator (at near end) is taken from the end of the tee, in order to favor the circulation of the radiator which responds more slowly, by giving it the benefit of the energy due to the velocity of the water. However, the supply connection for the riser feeding the radiators on upper floors is taken out of the top of the tee to take the air. The supply connection to this basement radiator pitches down toward the radiator, the radiator itself pitches down toward the return end, and the return connection pitches down into the return connection of the riser. When filling up the system the air from the return connection and the radiator, will naturally relieve out through the supply connection of the radiator into the supply riser—to be relieved from the radiators on the upper floors by the operator.

This arrangement makes it unnecessary to relieve the air from the basement radiators, which are not as accessible as those on the upper floors, and avoids the danger of freezing.

Figs. 10 and 11 show typical radiators located on the upper floors.

Requirement 6. That the following clause in the contract be complied with: *"Heating Test Guarantee."* Upon completion of the heating apparatus the contractor shall make a heating test in which the temperature of the water is to be raised from 80° F. in the boiler and in all of the radiators, to 185° in every radiator throughout the entire system in a space of time not exceeding one hour, and that then the circulation through each and every radiator shall be uniform.

FIG. 10—TYPICAL RADIATORS AND CONNECTIONS ON UPPER FLOOR.

This requirement only serves the purpose of laying stress on the other five

FIG. 11—TYPICAL RADIATOR AND CONNECTIONS ON UPPER FLOOR.

requirements, as set up by the writer, and can be conformed to if the boilers are of ample capacity.

Requirement 7. Guarantee Bond. In order to assure the installation of an apparatus, which would operate in accordance with the contract guarantees, the owners required the heating contractors to furnish a bond, amounting to twice the contract price.

Results of an Operation Test.

A preliminary operation test of the system was made before completion, that is, with fifteen radiators on the top floor of the main building still unconnected.

The day before the test, the fires in the boilers were kept very low and banked for the night at 6 P. M.

At 9 o'clock the next morning the fires were still burning and the apparatus was circulating at a very low temperature.

Readings of thermometers located in the various branch mains were taken as follows:

9 A. M.	Supply Deg. F.	Return Deg. F.
Boiler Header	90	82
Section D	89	83
Section J	86	81
Section M (last riser)....	84	80

A fairly good fire was started, in two boilers only, at 9.30 A. M.—using slack coal (bituminous) and temperature readings were observed as follows:

10.15 A. M.	Supply Deg. F.	Return Deg. F.	Temp. Drop. Deg. F.
Boiler header	100	80	20
Section B.....	96	82	14
Section C.....	95	82	14
Section D.....	95	80	15
Section E.....	94	81	13
Sections F and G.	94	79	15
Section H.....	93	80	13
Section J.....	93	80	13
Section K.....	93	81	12
Sections L and M	90	78	12
Section M (last riser)	84	73	11
10.30 A. M.			
Boiler mains	107	83	24
Section D.....	98	82	16
11.15 A. M.			
Boiler header....	118	88	30
Section B.....	115	94	21
Section C.....	114	94	20
Section D.....	114	93	21
Section E.....	113	93	20
Sections F and G.	112	92	20
Section H.....	110	89	21
Section J.....	108	88	20
Section J (last riser)	108	89	19
Section K.....	108	90	18
Sections L and M	107	86	21
Section M (last riser)	102	84	18
11.35 A. M.			
Boiler mains	122	92	30

It is to be particularly noted from the above record (11.15 A. M.) that the system was not as yet in thorough circulation. The supply water had, however, reached the last riser, with a 16° loss in temperature, and was circulating at a drop of 18°, therefore, the water in the convent end of the return trunk main was going back at 84°, and mixing with the warmer water coming into the trunk main from the nearer sections, finally reaching the boiler at a temperature of 88° (30° less than supply water).

Between 11.30 A. M. and 2 P. M. the boilers were fired evenly to maintain a temperature of 120° F. at the boiler supply header. This period of time allowed the water in the system to circulate thoroughly at a constant supply water temperature, and caused the system to reach a state of equilibrium; in other words the gravity circulation head (due to the difference in weight between the supply water and the return water) had overcome the frictional resitance of the piping of the various sections and established a constant flow of water. In order to obtain absolutely uniform circulation, the water flowing through each radiator must circulate with the same drop in temperature between the supply and return.

The supply water temperature was purposely fixed at 120° F. for this circulation test, as this temperature will permit the hand to be placed and remain on the radiator without discomfort. By feeling the top and the bottom of each radiator one can judge with sufficient accuracy the relative uniformity of circulation of the individual radiators. Using, however, the actual tem-

perature readings of the thermometers in the supply and return mains, for the purpose of a comparison of the temperature drops of the different sections.

It was found that all of the radiators connected (535) were circulating thoroughly and uniformly when all valves throughout the entire system were open wide. All the radiators in the near sections were circulating as evenly as those in the far sections, and those on the lower floors as good as those on the upper floors.

The following temperature readings will indicate how uniformly the various groups or sections were operating.

(Note:—The readings of the supply water temperature from the boiler header to Section "M" show the loss in temperature as caused by the exposed mains.)

2 P.M.	Supply Deg. F.	Return Deg. F.	Temperature Drop Deg. F.
Boiler header	123	105	18
Section B	121	103	18
Section C	120	101	19
Section D	120	104	16
Section E	119	102	17
Sections F & G	117	101	16
Section H	117	102	15
Section J	117	103	14
Section J (last riser)	117	103	14
Section K	117	103	14
Sections L & M	116	100	16
Section M (last riser)	114	99	15

A preliminary test was made to ascertain the speed with which the temperature of the water could be raised, using, however, only two boilers and a very poor quality of coal (slack, bituminous).

	Supply Deg. F.	Return Deg. F.
2.30 P.M.		
Boiler header	124	106
2.45 P.M.		
Boiler header	140	108
3 P.M.		
Boiler header	146	114
3.15 P.M.		
Boiler header	154	117
Section D	153	123
Section J	144	118
Section K	144	120
Sections L & M	138	119
3.30 P.M.		
Boiler header	160	124

It is to be noted from the above that the temperature of the water was raised 16° during the first 15 minutes of firing, which is approximately 1° per minute. If four boilers had been fired and a better grade of coal had been used, the temperature, no doubt, could have been raised at least 2° per minute, if not more. The faster the temperature is raised during the first 15 minutes the greater the available circulation head will become to circulate the water. Furthermore, to meet the requirements of the "Guarantee Test" it would be necessary to raise the temperature as high as possible during the first ten or fifteen minutes, so as to succeed in establishing a circulation in the far building, as quickly as possible.

DIFFICULTIES OF CORRECT DESIGN.

An engineer designing a large gravity hot-water system has to contend with innumerable conditions which are likely to affect his calculations of resistances throughout the system.

1. There is always the possibility of requiring more fittings in the risers, riser connections and radiator connections, due to uncontrollable conditions at the building.

2. The piping must be erected carefully so as not to contain grit, sand, or obstructions of any kind, which would surely increase the resistances of the circuit.

3. The engineer is limited to commercial sizes of piping, which makes it necessary to equalize resistances in a given circuit, by perhaps using one size pipe for the supply connection and a smaller size pipe for the return connection. Or, perhaps, to use a certain size for a part of the distance, then reducing to a smaller size by means of a reducing coupling or reducing elbow.

These difficulties are present in every installation, more or less, but the designing engineer soon learns by experience to make allowances for additional resistances in circuits where there is a probability that extra fittings may be required.

In order to be able to install a sys-

tem which operates perfectly the writer considers it absolutely essential to calculate the resistances as closely and accurately as possible before the construction work is started. Then if structural conditions at the building demand changes in the piping system, it will be necessary to make proper re-calculations, so as to still maintain the required balance of frictional resistances.

CONCLUSION.

The following is a comparison between the requirements as mentioned under "Design of Piping System," and the actual results of the operation test of the system.

Requirement 1: That each and every radiator, whether located in near or far buildings, or whether located in basement or top floor, circulate thoroughly and uniformly at a temperature of about 100° F., as well as 200° F. in the supply main.

Previous temperature readings show that all radiators do circulate at a temperature of even less than 100° F. Furthermore, it is true that, if a system operates uniformly at a low temperature, it will also operate in the same manner at high temperatures. The most stringent test for a gravity hot-water system is uniform circulation at low temperature of supply water.

Requirement 2: That all rooms be heated to 70° in zero weather. This guarantee, of course, is a usual one to heating contractors. In view of the fact that all previous installations, as designed by the writer, have been successful in this respect, also that extreme precautions were taken to allow for the cooling of the water before it reached the radiator, it is safe to assume that the system will operate in accordance with this requirement.

FIG. 12.—RADIATORS AND CONNECTIONS IN CHAPEL, ST. ELIZABETH HOSPITAL.

Requirement 3. That no valve in the entire system be permitted to be throttled,—perfect circulation to be obtained by proper design.

All of the temperature readings given hereinbefore were taken with all valves open wide, not a single valve being permitted to be throttled. The results as seen by a study of the temperature drops of the various sections is proof enough that a reasonably perfect proportioning and balance of frictional resistances was obtained in the system by proper design of the pipe sizes.

Requirement 4: That radiators located in distant buildings begin to circulate at about the same time as those

located in near buildings; or, when the system is in circulation, that any changes in temperature of the water can be obtained throughout all of the radiators within a reasonable time.

It is proven by a study of the temperatures of supply water in the various sections, taken at 10.15 A.M., that the system operates in accordance with requirement. The reason of success was the proper choice of levels at which the various branch mains were taken off the supply and return trunk mains; also, the fact that the near branches were taken out of the bottom of the trunk mains. Even under these conditions, which seemed favorable to the far sections, the near sections A, B, C and D, did actually circulate a trifle sooner than the convent building sections (L and M).

Requirement 5: That the system, when once filled to the proper level in the expansion tank, shall not require the venting of the radiators.

The apparatus in a partially completed condition had been in operation about two months under conditions of temporary heat. It required about two weeks, of continual operation before all of the air had relieved from the top of fittings, irregularities of the piping, etc. After that time all of the radiators in the building were tested for air at intervals of two weeks, but in not a single case was any air obtained from the air relief cocks. It is understood, of course, that the tops of the risers were *not* connected to the expansion tank by means of an air-line, as it is entirely unnecessary. In some buildings it is impossible to install piping hung from the top floor ceiling.

Requirement 6: Contract clause—"Heating Test Guarantee." This is an unusual requirement, as operating conditions will never require the water in the system to be raised from 80° to 185°. However, it was inserted in the contract by the owners, to compel the installation of an apparatus that would be reasonably responsive to desired changes in temperature.

The writer wishes to state that a gravity hot water heating system can be made to operate successfully and economically in very large buildings, under certain necessary conditions of levels of boilers and radiators, etc.

Also that the cost of installation, operation, and maintenance of a gravity hot water heating system, when designed according to economical and scientific methods, will compare favorably with other types of heating systems, in fact, will show up at a better advantage under certain conditions.

It is most advantageous in all respects to calculate a proposed system in great detail, so as to secure an installation as near perfect in operation as possible. Unnecessary expense of piping, fittings, labor, etc., are avoided by proper design, and no end of trouble spared in making adjustments of valves, changes in pipe, etc., in order to obtain even a fair circulation in some radiators.

This installation proves that a large system can be installed to operate uniformly without experimentation after completion.

Serious consideration must also be given to the fact that the owner's or architect's confidence in the ability of the engineer or contractor is destroyed, if a system is installed that requires endless tinkering and adjustments. As a result of this lack of proper knowledge and experience, one is not surprised at the prejudice held against hot water heating systems in general.

The system as installed in this building was designed by means of special tables made up jointly by O. H. Schlemmer, Jr., and the writer. They have been used in designing a considerable number of gravity and forced circulation hot water heating systems throughout the country, and conform with years of practical experience.

Air Ozonation

By Milton W. Franklin.

Editor's Note.—*Additional data on the use of ozone in ventilation, supplementing his previous observations (published in* The Heating and Ventilating Magazine *for October and November,* 1913) *were presented by Milton W. Franklin at the recent meeting of the American Society of Heating and Ventilating Engineers in Cleveland, O., July* 9-11, 1914. *The new points brought out by Dr. Franklin are given in the following abstracts:*

The application of ozone to ventilation has attracted much attention recently owing to the publication of a multitude of conflicting opinions concerning its merits. This confusion is due to several circumstances. In general, the proponents of ozone have claimed too much and have advanced many contentions, either insufficiently supported or in the very nature of things unsusceptible of proof. On the other hand, the opponents of ozone have attackd these claims with great energy and often have gone so far as not only to deny any usefulness whatever to ozone, but positively to affirm its harmfulness and dangerous character. In many cases the attacks on ozone have been directed against imaginary claims that were never made and much of the evidence against ozone is based on laboratory experiments which bear little or no resemblance to actual working conditions and therefore can scarcely be considered as authentic.

A careful and unbiased investigation of all the evidence accessible in the extant literature in connection with the theory and principles of ventilation hygiene must result in the conviction that ozone, properly applied, is capable of advancing greatly the art of ventilation and that it is incapable of harming persons exposed to its influence.

No single instance of harm to a person from the proper use of ozone in ventilation has been recorded, but on the contrary, all adverse opinions have been deduced, by inference, from laboratory experiments performed with very high concentrations, while all efforts to produce harm experimentally with weak ozone have failed. Jordan and Carlson report that twenty-six animals, exposed for fourteen days, during nine hours each day, to concentrations high enough to cause irritation of the eyes and nose, suffered no ill effect whatever. Gminder cites the unharmed workers in the spinning mills at Reutlingen. Erlwein (1) says:

"It is a fact at any rate that there have never been proven cases of sicknesses of a serious character due to breathing ozone air. Special attention is called to a large water sterilization plant operating for more than ten years, where the working force is constantly moving in an atmosphere which is more strongly mixed with ozone than is ever found in actual ozone ventilation installations. There has never been a case where these persons have been forced to be on sick-leave due to the high ozone concentrations in the plants."

Numerous similar instances of prolonged proper use of ozone without a single complaint are in existence.

Irritation of Mucous Membranes Caused by High Concentrations.

Efforts to disinfect occupied rooms have shown that ozone, in concentrations sufficient to produce sterility of the cultures, is irritating to the mucous membranes of the respiratory tract and in fact will produce death in guinea pigs, but as pointed out above, sterilization of atmosphere has little sanitary value and it must be remembered that no known method of room disinfection can be practiced in the presence of room occupants. Sulphur dioxide, hydrocyanic acid and formaldehyde would produce death in guinea pigs more rapidly than would ozone. It has been shown that ozone in high concentrations is a local mechanical irritant but there is no evidence to justify the opinion that it is injurious in low concentrations.

DIFFERENCE BETWEEN CHEMICAL AND MECHANICAL POISONS.

Toxicologists recognize two distinct classes of poisons: namely, physiological or chemical poisons and mechanical poisons. The former act by being absorbed into the system and causing trains of phenomena through the nervous mechanism; the latter act merely by causing local destruction of the tissues with which they come into direct contact. Strychnine is an example of a chemical poison; its action is dependent only on the quantity ingested and is wholly independent of its concentration. One grain administered internally will cause death, whether it be taken pure or copiously diluted with water. An example of a mechanical poison is sulphuric acid; its only action is a local destruction of bodily tissues, and a quantity which would cause death, if administered concentrated, might be taken with impunity when accompanied by a sufficient diluent. Ozone has been shown to be a mechanical irritant, but to deduce the result that because strong ozone is harmful, weak ozone also must be harmful, is equivalent to arguing that because 50% oxygen breathed for a certain period will cause death from inflammation and edema of the lungs, the 20% oxygen, such as we inspire at every breath, is also poisonous.

NEGATIVE EFFECT OF OZONE ON ANIMALS.

Experiments conducted by Jordan and Carlson to determine whether or not ozone in low concentrations, somewhat higher than might be used in ventilation, is harmful, have resulted in the following conclusion:

"All the animal groups showed some increased body weight, but the increase during the ozone period is practically the same as during the control period. Slight differences are of no significance. Hence, as regards appetite and body weight, the results of the tests are negative, the ozone appearing to have neither a favorable nor an unfavorable influence. This applies also to the general conditions of the animals. The cats did not seem disturbed, even when the ozone concentration caused some restlessness in the rabbits, guinea pigs and rats. In all other respects the animals appeared to be normal."

This is a convincing demonstration of the harmlessness of even too high ozone concentrations. The animals were exposed for fourteen days to ozone, following a period of fourteen days confinement for control observation, but in spite of the prolonged close confinement and extremely inadequate ventilation (16 cu. ft. per hour per animal), they thrived as well during the second fourteen days with rather too strong ozone as during the first fourteen days.

HOW OZONE IS VALUABLE IN VENTILATION.

So far as is definitely known the value of ozone in ventilation is not due to any beneficial effect upon the human economy but to the circumstance that it destroys much that may be objectionable or harmful in foul air. The air is not better because it contains ozone but because this ozone signifies the absence of such organic effluvia as otherwise would be obnoxious.

The well established fact that ozone is a powerful germicide in the presence of water has led to much experimentation and speculation on its possible power of destroying the bacteria in the air. Wyssokowitz (2) experimented with chemically formed ozone and found a diminution in the air bacteria, but owing to the many possible errors in his method of procedure his results are frankly admitted to be of little value. He attributed the effect observed to the simultaneous formation of acid, which rendered the soil unsuitable for the growth of bacteria. Froelich (3) found some diminution in air bacteria with strong ozone. Sonntag (4) found no effect of ozone in low concentrations on dry bacteria, but with extremely high concentrations (13.5 gm. per cbm.) the bacteria were destroyed. Konrich also obtained negative results with cultures dried on strips of filter paper and on glass rods. Labbé and Oudin produced diminution in the bacteria count but they admit that their results are of little importance, owing to possible sources of error.

Bail (5) has experimented quite extensively and states:

"Even strong ozonization of the enclosed air with circulation never allow-

ed the beginning percentage of the air as regards bacteria to be reduced in a conclusive manner. The bacteria in the air were determined either on open agar plates, or else by passing known quantities of air through gelatine. Passing air, ozonized as much as possible in the apparatus, through tubes having powdered bacteria or through loose sand containing bacteria gave no conclusive indication of an effective action of the ozone on the bacteria. Experiments to change the humidity of the air by evaporating water during ozonization and circulation produced no changes in the results."

Jordan and Carlson found little or no effect on plated and dried cultures with low ozone concentrations, but in four tests on the bacteria suspended in the air, three showed an average decrease of 53% and one showed an increase of 10%. Franklin (6) showed a decrease in the bacteria suspended in the air but the ozone concentration probably was relatively high.

DRIED BACTERIA NOT AFFECTED BY LOW CONCENTRATIONS OF OZONE.

The general evidence of laboratory experimentation seems to indicate that low concentrations of ozone, at least, have no consistently demonstrable action on dried bacteria, whether in cultures or floating in air. On the other hand, there is a considerable amount of evidence to the effect that in storage cellars and similar places the growth of fungi, molds and similar micro-organisms is impeded, if not totally repressed, by even weak ozone concentration applied for prolonged periods. A possible explanation is afforded in the work of Trillat (7), who has shown:

POSSIBLE EXPLANATION AS TO BENEFICIAL USE OF OZONE IN CELLARS TO PREVENT MOLD.

"That the transport of pathogenic microbes in the air is effected especially by the damp which contains, in an infinitesimal state, traces of gas-aliments. Moreover, it would seem that the air, when it fulfills certain conditions of dampness, of chemical composition, of temperature, and of age of microbes, is capable of being fertilized directly by the contact of a microbian source. Up till now it was thought, according to numerous observations, that for microbes to be transported by the air it was necessary to project them into it by some mechanical action, such as pulverization or any other means, the effect of which would be to detach them from their support. Contrary to this notion, Trillat and Fouassier have established experiments demonstrating that when the superposition of certain factors takes place, the sowing of the air is performed in the same manner as that of a bouillon culture, merely by the play and movement of the invisible vesicles which constitute the humidity of the air. In an infinitely feeble volume of about one hundred-thousandth of a cubic millimeter these tiny drops are uninfluenced by the action of the force of gravity. They are always mobile under the influence of the least variation of temperature. M. Trillat and Fouassier have shown how the contamination of the air takes place in a closed and tranquil space, without the intervention of the presence of dust or of any mechanical means, as was believed up to the present time."

It seems probable that the gradual lessening in the bacterial count in the air of places that have been ozonized for some time is due, not to direct influence of ozone on the bacteria, but to the alteration in the air as a culture medium and also to the fact that the myriad cracks and crevasses in the walls, ceiling, hangings, furniture, etc., which harbor cultures that constantly supply bacteria to the air, are gradually exhausted. This would account for the discrepancy between laboratory tests of brief duration and actual prolonged trials.

RECENT TESTS ON ODOR DESTRUCTION.

In addition to the odor destruction tests outlined above and already published, further tests have since been made with casein and with tobacco smoke. The casein tests were undertaken with the object of destroying the odors arising from a factory producing about 500,000 pounds casein per month. This material had a very bad, nauseating odor. In drying the material, air is passed over it or through it, and this

takes up part of the disagreeable odor. This air then passes up a stack and out into the atmosphere, where it proves a nuisance to the neighborhood. The problem is to destroy the odor before it passes up the stack.

Tests were made on the effluvium from the casein to determine whether ozone would affect it. For this purpose about 15 gm. were put into a Petri dish under a bell jar. When the air had become saturated it was caused to displace the water in a Wolff bottle. A measured amount of this effluvium was then allowed to mix with a measured amount of ozonized air of known concentration. Several tests were made, using various quantities of ozone, any odor due to excessive ozone being removed with ferrous sulphate. In each case the odor due to casein was destroyed. The least quantity of ozone which sufficed was 1.84 mg. per liter of effluvium; 1.75 mg. per liter left a slight trace of the odor. The results are presented herewith:

1. 1 L. of effluvium was entirely deodorized by 0.47 mg. of ozone, with a distinct excess of ozone.

2. 11 L. of effluvium were entirely deodorized with 0.41 mg. of ozone or 0.037 mg. per L. with excess of ozone.

3. 14 L. of effluvium were deodorized with 0.171 mg. of ozone or 0.012 mg. per L. with excess of ozone.

4. 0.0057 mg. ozone per liter of effluvium materially lessened the odor but did not destroy it entirely.

CONCLUSIONS.

The proportion of air to casein in the experiment was less than in the most unfavorable case that the factory conditions exhibit. The casein used was in a much more advanced state of decay and probably had odors that were far stronger than are ever obtained at the factory. Complete elimination of the odor was the object in the experiment, and this was obtained at will. The qualitative tests which preceded the quantitive tests demonstrated that actual destruction and not masking of the odor was attained.

EFFECT OF OZONE IN DIMINISHING SMOKE DENSITY.

The destruction of the odor of stale tobacco smoke and of old moist cigar stumps has always constituted a most graphic illustration of the power of ozone. Rooms in which much smoking has occurred retain the odor of tobacco in the walls, hangings and furnishings and this odor is enduring and persistent. Experiments in which it was shown that the odor imparted to cheese cloth by tobacco smoke could be destroyed by ozone have been published in the previously cited paper (8). There seems to be some difference of opinion, however, regarding the effect of ozone on the smoke present in an occupied room during the actual smoking, and where the ozone is of such strength as to be comfortably borne by the room occupants.

Hill and Flack (9) noted that the apparent density of the smoke diminished and that the odor disappeared. Kisskalt, Schwartz and Münchmeyer (10) noted a lessening in the smoke density and total disappearance of the odor. Cramer (11) states with regard to experiments performed on a large scale:—

"All that could be clearly demonstrated was the fact that the smoke haze became appreciably lighter and that the pungent characteristic of the smoke disappeared, rendering it no longer irritating to the eyes."

Czaplewski (12) states:—

"In our own tests with stronger ozone concentrations, cigarette smoke was entirely destroyed in a room so as not to be perceived by a person entering the room from the outside. There was no 'after' smell and tobacco smoke on clothing is disposed of by ozone."

Smoke consists of particles of carbon and of various volatilized pungent and aromatic substances. Only the latter give taste, smell and irritating properties to smoke, the carbon contributing most of the visibility. The volatile elements in smoke exist in the gaseous form: i.e., in a state of molecular subdivision, but the carbon particles exist in the shape of molecular aggregates, each of infinite size compared with the molecules themselves, otherwise they would not be visible. Ozone can combine only with the volatile elements in smoke. It thus renders it odorless, tasteless, and incapable of causing irritation, but it cannot burn

the carbon which in any event is totally inert and harmless. Numerous tests with actual smoke have shown this to be true.

DESCRIPTION OF TESTS.

In my own tests I have observed that when the ozone is turned on in a smoke-laden atmosphere the density of the smoke lessens and the odor and pungency disappear, the smoke being entirely undetectable excepting for its visibility. For some time I have suspected that the apparent diminution in visual density might be due to stirring up of the air by the fan which is attached to all the ozonators with which I have experimented in this direction. Some experiments were performed to determine whether or not ozone actually diminshed the smoke density.

FIG. 1.—GENERAL ARRANGEMENT OF APPARATUS TO DETERMINE WHETHER OZONE DIMINISHES SMOKE DENSITY.

The general arrangement of the apparatus is shown in Fig. 1. Wolff bottles of 2 L. capacity, and furnished with a tubulure at the base, were filled with water. One of the necks was stoppered and the other attached by a rubber tube to a glass funnel inverted over a quantity of burning tobacco. The tobacco was burned on a thin flat iron plate by means of a gas burner placed underneath. The funnel was supported with its rim about ½ in. above the plate and directly above the tobacco. When the tubulure was opened and water permitted to flow from the Wolff bottle, the air which replaced the water flowed under the edge of the inverted funnel and over the burning tobacco, whose smoke was carried along with the air. In this manner each of two bottles was half filled with a dense cloud of smoke. One of these bottles was then connected to the ozone line and the remaining water replaced by ozonized air, leaving about ½ in. of water in the bottom of the bottle. Into the other bottle atmospheric air was introduced in the same manner. The bottles were then shaken to cause the water to mix the smoke and air thoroughly, and the bottles were placed

side by side on a shelf and observed after various periods of time. The results are presented in the following tabulation:—

I	II	III	IV	V	VI
Test No.	Ozone mg.	15 min.	30 min.	1 hr.	4 hrs.
1	1.05	slightly clearer	slightly clearer	marked clearing (slight)	marked clearing
2	0.92	slightly clearer	slightly clearer	slightly clearer	marked clearing
3	1.10	no difference	slightly clearer	slightly clearer	slightly clearer
4	1.13	slightly clearer (?)	slightly clearer	marked clearing	marked clearing
5	0.96	slightly clearer	slightly clearer	slightly clearer	marked clearing (slight)

The remarks under columns III, IV, V and VI refer to the bottles containing smoke, air and ozone, directly compared with the corresponding bottles containing only air and smoke. The tobacco was of a standard inexpensive "cut plug" variety sold in ten cent packages and was rather sweet, strong and moist. The amount of tobacco was very nearly 2.0 gm. in each case and was completely burned, the whole gaseous products of combustion entering the Wolff bottle. There was considerable condensation on the funnel at first, but later this decreased greatly, as ascertained on weighing the funnel, and the results given are of the later tests. The smoke in the bottles was much denser than could be obtained in any room by persons smoking.

It will be seen that in the bottle containing ozone the smoke, in general, cleared sooner than that in the bottle containing only air. The difference, though always unmistakable after several hours, was only occasionally quite marked.

Fig. 2 presents a case in which the difference was very pronounced. The amount of clearing after the lesser periods of time was so slight as often to be questionable, but in general it can be said that the ozone makes a slight reduction in the smoke density. In each case the smoke settled slowly in a cloud, leaving the top of the bottle clear. The "conglomeration" noted by Cramer (13) was seen only in one test (No. 3) and then only faintly.

It might be concluded from the above tests that ozone is capable of lessening somewhat the visual density of tobacco smoke, but when it is remembered that the ozone concentration was about 1 gm. per cbm. it hardly seems probable on first thought that the clearing noted when ozone at a concentration not exceeding 1 mg. per cbm. is turned into a smoky room, is due alone to the action of the ozone. However, a consideration of the quantities involved indicates that this may well be true. In the tests the products of combustion of 2 gm. of tobacco were collected in the space of 2 L. in approximately 2 minutes. This would be equivalent to burning 41 kg. tobacco in a room of 41 cbm. (12 ft x 12 ft. x 10 ft.) in 2 minutes. Five men smoking pipes in such a room would burn only 4.3 gm. in the same period. Thus the ratio of tobacco consumption in the above described laboratory tests and in this hypothetical case is approxi-

FIG. 2.—COMPARISON OF CLEARING EFFECTS ON TOBACCO SMOKE OF OZONE AND AIR.

mately 10,000: 1, while the ratio of the ozone concentrations is only 1,000: 1, or in a similar actual case occurring in practice the amount of ozone would be about ten times more in proportion to the tobacco than in the tests described. Besides this there would be approximately 10,000 times as much air for the smoke to diffuse into and a marked clearing action is exercised by the air, which may be intensified by the action of the ozone.

The estimates of the amounts of tobacco consumed are based on measurements of ten pipes and on timing different smokers. The average amount of tobacco (of the kind used in the experiments) held by the pipes was 1.62 gm. and the average time of smoking was 38 minutes. In all cases the odor of the smoke was markedly or even completely removed, leaving it odorless, tasteless and with no power to irritate the mucous membranes of the eyes, nose or mouth.

ANOTHER TEST WITH CLOTH STRIPS PERMEATED WITH TOBACCO SMOKE.

Fragments of cloth were cut into strips 5 cm. x 8 cm. and suspended in a bell jar having a tubulure at the bottom and a neck at the top. The latter was connected to an aspirator and tobacco smoke was drawn in at the tubulure. After the smoke from 2.5 gm. of tobacco had permeated the cloth strips the latter were removed and examined; they smelled strongly of tobacco. They were then replaced in the bell jar and ozonized air was drawn through for varying periods of time. The concentration was 1.03 mg. per cbm. The results were as follows:—

Test No.	Material.	Result.
1	Cheese cloth (thoroughly washed)	Thoroughly deodorized— 9 min.
2	Cheviot (cut from an old suit)	Thoroughly deodorized—29 min.
3	Satin (cut from lining of old suit)	Thoroughly deodorized—18 min.
4	Duck (new)	Thoroughly deodorized— 6 min.

No. 1 became most strongly odorous with the same exposure as the others. After a rest of 12 hours No. 2 experienced a slight though distinct return of odor, which, however, disappeared finally with 5 minutes' additional ozonation. The comparative thickness and microscopic complexity of the cloth undoubtedly accounts for this phenomenon.

(*See page 46 for further discussion of this subject.*)

CONCLUSIONS.

From the evidence presented, the following conclusions may be drawn:—

Ozone is in no sense poisonous, though in great concentrations it is capable of causing local irritation of the mucous membranes with which it comes in contact.

Prolonged ozonation is capable of ridding, at least in a measure, the atmosphere of food storage rooms of germ life, probably through rendering it an unsuitable medium for their support.

Ozone is a valuable adjunct to ventilation, its function being the destruction of odor with consequent partial purification of the air; there is nothing either in the theory or in recorded experience to warrant its use for curtailing ventilation.

The analogy between laboratory tests and actual practical applications is often so obscure and replete with modifying factors that the extremest care must be exercised in applying the results of experimental observations to practice.

REFERENCES.

1. Erlwein, Zeit. f. Sauer u. Stickstoffindustrie, 1913, Nos. 7 and 8.
2. Mitt. a.d. Bremer Heilanstalt, Wiesbaden, 1890.
3. Electrotech. Zeit., 1891, p. 340.
4. Zeit. f. Hygiene, Vol. 8, 1890.
5. Prag. med. Wochenschr., 1913, No. 17, p. 216.
6. M. W. Franklin.
7. A. Trillat, Orig. Comm. VIII. Int. Cong. Appl. Chem. 19, p. 71.
8. M. W. Franklin, ibid.
9. Hill & Flack, Proc. Roy. Soc. Ser. B. Vol. 84, p. 404.
10. Kisskalt, Schwartz & Münchmeyer, Chemiker Zeit., 1912, No. 129.
11. Cramer, Gesundheits Ing., 1909, p. 498.
12. Czaplewski, ibid.
13. Cramer, ibid.

Progress in Gas Heating Science

By O. K. Kuenhold.

Read Before the American Society of Heating Engineers at Cleveland, Ohio, July 9, 1914.

The scientific design of gas warm air furnaces and hot water boilers is one of growing importance. Each year sees more buildings heated with both natural and artificial gas. At the present time heating with natural gas is undergoing remarkably rapid extension, but within the next ten to twenty years heating with manufactured gas will unquestionably make equally rapid strides.

Natural gas has the great advantage of low cost as compared to coal gas. It is used extenively in the States of New York, Pennsylvania, Ohio, Indiana, West Virginia, Kentucky, Oklahoma, Kansas, Arkansas, Missouri, California and others, as well as the provinces of Ontario and Alberta, in Canada. In many cases the gas is conveyed by means of pipe lines to cities several hundred miles distant from the gas fields. The permanence of these gas fields has been the subject of much attention. The generally accepted opinion is that the best of the present fields will probably last at least another generation and probably longer. New fields are also being discovered and developed.

It is producer gas, however, to which gas engineers look for the greatest possibilities in relation to heating buildings. Producer gas can be made much more cheapy than illuminating gas. When illuminating gas is distilled from a ton of coal there is three quarters of a ton of coke left. When producer gas is generated from coal there is nothing left but ashes. The cheapest grades of coal may be used, so poor in quality that it hardly pays to ship it from the mines.

The logical development in the gas industry is to place the gas producing plants at the coal mines, generate the gas there and transport it to distant cities. This would eliminate the quite considerable expense of sorting, screening, handling, storing, transporting, etc., and attending losses, which are necessary under the methods at present in vogue.

Indeed some gas producer engineers go so far as to say that hoisting the coal from the mine to the surface is unnecessary expense and that the gas producer should be placed in the mine and generate the gas there.

FUTURE OF ILLUMINATING GAS.

Referring again to illuminating gas as now made in cities, as a fuel for heating buildings, there are a number of facts pointing out the probable future development in this direction that are food for thought. City gas has been steadily dropping in price during the past twenty years, while the price of coal has with equal steadiness advanced and will most surely continue to do so.

Electric illumination is making such inroads into gas sales that the gas companies must develop other fields than gas illumination, in order to dispose of their output. Many gas companies are offering special rates, where gas is used for heating purposes, and are finding it a profitable venture. This move is spreading rapidly. A notable example is St. Louis, where about two hundred buildings are heated by manufactured gas. People are demanding comfort, cleanliness and convenience in their homes, and many are willing to pay an increased amount for gas fuel to eliminate coal and its attending evils from their residences.

The damage done by coal smoke in cities is being realized and initial steps being taken to prevent it. The United States Government is making extensive investigations upon this subject.

These few facts show how the price of heatng with coal as compared to manufactured gas is approaching closer and closer. In many cases circumstances make even expensive coal gas so much more desirable than coal as a fuel that coal is out of consideration.

PRIVATE GARAGES BEING HEATED BY GAS.

One example of the above is in *pri-*

vate garages. These must be heated to prevent the automobile radiator from freezing; make starting the engine easy; and for many other reasons. The method of heating must be rapid, convenient, clean, compact, and last, but by no means least, the heater must be safe when gasoline fumes occur. Gas heat offers the only solution.

In some sections of the country, such as southern California, the weather is warm during the day, but quite chilly at night. To heat with coal demands building a fire every morning. In mild weather coal heating appliances are difficult to control and are very efficient, while gas appliances are highly efficient in comparison. Under circumstances such as these, gas furnaces or boilers represent a convenient and economical solution.

COMPARISON OF GAS AND COAL EFFICIENCIES.

In comparing the efficiencies of gas furnaces or boilers to those of coal furnaces or boilers, there is one point which should be noted. Every coal heater has its maximum efficiency at a certain rate of combustion. When this rate is exceeded the efficiency drops. Also when the rate of combustion is less the efficiency drops, because of decreased temperature in the combustion chamber.

In gas furnaces or boilers wherein the air supplied for combustion is regulated separately to each burner the efficiency increases and the lower the rate of gas combustion the higher the efficiency. With chimneys of good natural draft and well laid out heat distribution an efficiency of close to 100% is at times attained.

In a climate like Cleveland the average temperature during the severe months is 38° F. The house temperature is therefore raised on an average of 32° during two-thirds of the day and 22° during one-third of the day. The average rate of combustion of fuel is therefore low. This results in lower average efficiency for coal furnaces and higher average efficiency for gas furnaces than is shown bv laboratory tests, as same are usually made.

For these reasons, in estimating gas bills on proposed replacements of coal heaters, the writer submits the following comparative percentages of efficiency as in his opinion giving as accurate results as may be expected under the many varied conditions which influence the actual results.

With coal at $5.00 per ton about 6,000,000 B. T. U. are obtained for $1.00. With natural gas at 30 cents per 1,000 cu. ft. only about 3,333,000 B. T. U. are obtained for $1.00. In order for natural gas to compete with coal as a fuel it is necessary to obtain a much higher efficiency. Since in using gas all the factors making for higher efficiency are much easier to obtain, natural gas furnaces or boilers properly designed can be operated at about the same price as coal costing $4.50 to $5.00 per ton, and about 30% cheaper than anthracite coal at $7.00 per ton.

The efficiency of a coal furnace or boiler under the usual conditions probably averages less than 50% for the entire winter, while a good gas furnace should average close to 90%. Experience in several hundred cases where gas furnaces were installed in place of coal furnaces, and the fuel bills compared indicates that the rates of the efficiencies of gas and coal furnaces must be quite close to the above.

This gives us a basis which may be used in estimating the probable cost of heating with gas as compared to coal, provided that we know what the coal bills have been for the house considered, the heat unit value of the gas, and the cost of both the coal and the gas. To illustrate this assume that for a certain house the coal used during an average winter amounted to 10 tons at $8.00 per ton, probably containing 14,500 heat units per pound. At an assumed average furnace efficiency of 50 per cent., which is high, this would amount to 145,000,000 heat units put to use in order to heat the building all winter.

Comparing this with manufactured gas of 600 heat units per cubic foot at a special rate of 60 cents per 1,000 cu. ft., and taking as our basis 90 per cent gas furnace efficiency, the same house would require 270,000 cu. ft. of gas, which at 60 cents per thousand would cost $162.00, as compared with $80.00 for coal, considering fuel cost only.

But in order to make an accurate

comparison there are other items to be considered. A complete comparison would be about as follows:

COST PER YEAR OF HEATING WITH GAS.

Fuel used	$162.00

COST PER YEAR OF HEATING WITH COAL.

Fuel used	$80.00
Kindlings	2.00
Hauling ashes	5.00
Damage to house and furnishings by coal and ash dust	30.00
Repairs and cleaning furnace	10.00
Attending labor and inconvenience (seven months at $5.00 per month)	35.00
Total cost	$162.00

It is assumed in the above that the gas furnace is under automatic control.

In order to heat with gas at the high efficiency necessary to compete with coal, the furnace or boiler must be designed especially for gas. In fact, we should go even further than that; we should design it for the *kind* of gas to be used, just the same as a coal furnace or boiler should be designed for the *kind* of *coal* to be used.

Experience in replacing coal furnaces using gas fuel, by furnaces designed especially for gas, shows a saving averaging not less than 33% and ranging from 20 to 70%.

DESIGN OF GAS HEATER IMPORTANT.

By examining the most successful gas furnaces and boilers it will be noted that a sort of a school of design quite different from coal furnaces and boilers has been developed. This probably is in accordance with the laws of "natural selection" and "survival of the fittest" maintaining in engineering practice. It is another verification of the contention of the writer that gas furnaces should be used for gas and coal furnaces for coal.

TWO DISTINCT FUNCTIONS OF GAS HEATERS.

In approaching the problem of gas heater design it shoud be borne in mind that two distinct functions are required of the appliance. *The first function is* the generation of heat from gas. *The second function is* the transmission of this heat to the heat conveying medium. By heat conveying medium is meant the *air* in a warm air furnace, or the water or steam in a hot water or steam boiler.

It is of vital importance that the first of these functions, i. e., the generation of the heat, is entirely completed before the transmission of the heat is begun. Both of these functions cannot be efficiently performed at the same time. Unless this most essential requirement is fulfilled, perfect combustion of the gas is impossible.

Let us consider these two functions one at a time, taking up first the generation of the heat, or, in other words, the combustion of the gas. We will not look into the details of burner and mixer design, but consider only the essential requirements for perfect combustion, of which there are only three, but these three are as essential to complete combustion as length, breadth and height are to solid geometry. The first is, proper proportion of air and gas. Second, thorough intermixture of air and gas. Third, a high enough temperature to make a complete chemical union of the oxygen in the air and the hydro-carbons of the gas possible. Unless all three of these conditions are fulfilled, complete combustion and, therefore, the generation of every possible unit of heat cannot be achieved.

The usual procedure in constructing gas heating appliances is to install a burner, leaving the proper air supply to change and making no effort to maintain a high enough temperature in the combustion chamber. A burner or group of burners alone applied to a gas furnace cannot give the best possible results. A complete system of combustion is necessary.

SCIENTIFIC COMBUSTION SYSTEM.

The writer has developed what he calls the *scientific combustion system* and this will serve to illustrate the principles herein set forth. In this system two or more oblong burners are arranged side by side. Above them is a combustion chamber, insulated on all sides to prevent appreciable loss of heat. Between the burners are cast-iron partition plates extending down to the floor plate about 10 in. below the top of the burners. Each burner, therefore, is in a separate compartment.

At the rear of each compartment is a

rectangular opening having a shutter pivoted near the center. The air required for combustion is admitted through this opening. The shutter is connected by means of a rod to a little lever underneath the gas valve in front of the heater in such a way that when the gas is turned on to any particular burner the air supply shutter of that burner compartment is opened in proportion to the opening of the gas valve.

By this arrangement if one burner is turned on full it will receive the full air supply. If another burner is turned on part way then the air shutter for that burner compartment will be opened only part way. Each burner will always receive only the amount of air required.

With the ordinary heater, in mild weather, if one burner is turned on, this will naturally induce a draft. The draft will draw air through the heater at those burners not being used and this air not being used absorbs a considerable proportion of the heat generated by the burner in use, cools the inner surfaces of the furnace or boiler and carries this heat up the chimney. In the scientific system, if one burner is turned on, this burner only receives just the amount of air needed and no surplus passes through the heater.

The second requirement mentioned referring to a thorough intermixture of the air and gas is largely a matter of proper proportion of the burner and mixer. The stream of mixed air and gas is broken up into a number of jets. Each jet should issue from a raised stool or nozzle, all so arranged that air will be supplied to each separate jet all around.

The third essential is that there should be a sufficiently high temperature in the combustion chamber to make perfect combustion possible. It is this requirement that is so often violated in many gas boilers and furnaces upon the market. In most gas boilers the bottom of the hollow water sections are extended downward into the flame. At first thought one would regard this as a highly desirable arrangement. But let us stop and think a moment what then happens. The bottom of the water section has an average temperature in a hot water boiler of 150°. The tip of a gas flame has a temperature of about 3000°. The difference in temperature is 2850°.

The cast-iron has a chilling influence upon the flame almost thirty times as great as a piece of ice upon the human body. What actually takes place is this: Whenever the flame comes close to the casting its temperature is reduced below the ignition point and that part of the flame is extinguished. It is in fact a chemical impossibility for the flame to come into actual contact with any surface the temperature of which is lower than the ignition temperature of the flame.

There is also another thin zone around the water section in which, while the temperature of the flame is reduced, it still permits the gas to be partly consumed to carbon monoxide. It is this gas which causes the peculiar pungent odor which may be noticed in the flue gases where a gas flame is chilled by contact with water coils or castings. The proper course to pursue is never to permit a gas flame to come into contact with any surface cooler than itself, if efficiency is the prime object to be attained. If the necessity of this principle were more fully realized, heating with gas would be more popular.

The main idea is this: First get complete combustion. When combustion is completed, but not until then, begin transmitting the heat into the air water or steam as the case may be. The cases in which exception may be made to the above is where speed is of prime importance such as in instantaneous water heaters, or in cases where it is not practical to encase the flame so as to present the escape of heat.

TRANSMITTING THE HEAT INTO THE CIRCULATING MEDIUM.

Now having disposed of the first function of a gas furnace or boiler, we may consider the second, which is to transmit the heat into the circulating medium The end aimed at in this is to extract as much heat as possible from the products of combustion, allowing only enough heat to remain in them to create a proper draft. The burnt gases in passing through the furnace should be retarded as much as possible, but at the same time must travel fast enough so that they leave the combustion chamber as fast as gen-

erated, otherwise the flame may be partially smothered. The draft may be retarded to advantage, much more than in a coal furnace.

A sufficient heat transmitting surface is necessary, however. It should be remembered that baffle arrangements, choked off dampers, etc., cannot be made a substitute for heat transmitting surface and proper interior circulation. The length of travel or combustion products must be much greater in proportion to the cross sectional area, than is the practice in coal furnaces, and the flue passages should be considerably smaller to obtain best results.

The vent pipe should preferably be attached at a low point. Hot gases rise, and cooled gases settle down. Let them settle down in the interior of the heater first, then carry them to the chimney.

Finally—the direction of travel of the burned gases and of the air or water should be in opposite directions. This the writer calls the *principle of opposed circulation,* and it is of great importance, although not used very much in furnace and boiler design.

To illustrate this principle let us examine the average gas boiler. The water enters at the bottom and leaves at the top. The products of combustion also enter the heating space at the bottom and leave at the top. Both travel in the same direction. This does not render the highest efficiency. The air or water should travel in opposed directions. In other words, the exhaust gases should leave the heater at the part where the cold air or water comes in, that is, at the part of the heater where they can be cooled to the lowest possible temperature before going to the chimney. The incoming water or air should travel toward the hottest part of the heater and just before it leaves is exposed to the hottest gases as they leave the combustion chamber.

With ample heating surface and the observance of the above principles flue gas temperature as low as 100° to 120° can be obtained and an efficiency of close to 90 per cent. Experience also shows that it would be safe to guarantee that the furnace or hot water boiler shall never exhaust the gases to the chimney as high as boiling temperature. In hot water boilers the vent pipe to the chimney will always be at a lower temperature than the outgoing water.

Another desirable essential of proper design may be mentioned. The air or water passing through the furnace or boiler should not be baffled or retarded any more than is absolutely necessary, so that it can flow through the heater freely and have the strongest and most rapid possible circulation. The quicker that the circulating medium flows through the heater the more heat will be carried away.

By inspecting some warm air heating plants one notices that extreme precautions are taken to provide free and easy flow of the air through the leads, but in the furnace the air is baffled in every conceivable way.

In some sections of the country gas furnaces are not popular because the gas pressure is unreliable in winter. In such cases there are plenty of reliable auxiliary furnaces upon the market which can be attached to the side of a coal furnace so that the gas may be used with efficiency, but not as high as where the gas furnace is installed in place of a coal furnace. All gas furnaces or boilers should preferably have arrangements for the temporary use of coal in case of emergency.

From the foregoing it will appear evident that it is extremely unlikely that a furnace or boiler can be designed which is highly efficient both with coal and gas fuel. The two problems are so different in many ways that the furnace must either be primarily a good coal furnace, a good gas furnace, or else a compromise between the two. Where the highest efficiency is demanded as in artificial gas territory, hot water systems and vacuum systems, in which about 8 in. of vacuum may be maintained upon the system at the boiler, give considerably better economy than low pressure steam systems in the experience of the writer.

Discussion on Gas Heating.

H. M. HART: The Prentice Co., of Chicago, at one time made some careful records of the cost of heating with gas at 50 cents per 1000 cu. ft., which showed that, taking the whole heating season, the cost of heating by gas equalled the cost of heating with coal at $16.00 per ton. I notice that the statement is made that the combustion chamber in a gas heater

should be so constructed that the flame will not strike the cold parts of the boiler. I think the same rule should apply to house heating boilers and coal burning boilers. There is considerable loss in the combustion of coal on account of the water jacket extending down below the bed of the fire so that the gases in the flames cool when they strike the colder iron of the boiler and thus do not fully ignite. I think if the fire-box of a house heating boiler was thoroughly insulated or if the water was kept above the bed of the fire a higher efficiency would be obtained.

O. J. KUENHOLD: If you compare the cost of operating a furnace designed for coal and using coal with the cost of operating a furnace designed for coal and using gas, you get a wrong perspective of the economical possibilities of gas. The problems of design in a gas furnace are entirely different from the problems of design in a coal furnace.

Let me give an illustration: In a coal furnace the leading factor influencing the rate of combustion is the draft. In other words the draft makes the fire, in a gas furnace it is just the reverse—the fire makes the draft.

There are many other points of difference. The great trouble is that most of those who design gas furnaces design them along coal furnace lines, or else they try to make what is called a combination furnace. This has been defined by one disappointed user as "a combination between the man who built the furnace and the gas company."

These so-called combination furnaces as used in Cleveland cost from 50 to 100% more to operate on 30-cent 1,000 B. T. U. gas than coal at $4.50 to $5.00 per ton.

With a properly designed gas furnace we can get the same results as to cost of operation as with $4.50 to $5.00 coal using 30-cent gas. When compared to hard coal at $7.00 per ton we can save 30%.

SECRETARY J. J. BLACKMORE: In regard to combination gas and coal boilers, I do not think any manufacturer who supplies boilers in the natural gas district can guarantee the same economy with both gas and coal in such a boiler. All through the natural gas territory in the winter the supply of natural gas frequently runs short, and the pressure is not sufficient to supply enough gas for heating purposes and the householder has to burn coal, hence the combination gas and coal boiler is put in as a measure of insurance so that they will never be without means to obtain heat.

Mr. Hart raised the question of combustion in a boiler. If we go back to the early days of boiler construction, we find that the majority of boilers were then made with the lower part of the fire box made of fire brick. They were afterwards made with a cast-iron water leg all the way down to the grate. The question resolves itself wholly into the rate of combustion of the fuel in the firebox and the rate of combustion depends upon the quantity of oxygen supplied and the temperature maintained in the firebox. If ideal combustion takes place it is quite immaterial how much water surface there is in the firebox, but the moment that the combustion slows down to two pounds of coal per square foot of grate surface per hour, then there is difficulty in maintaining the temperature high enough to keep the combustion at an economical point, because a certain amount of the gases will escape unconsumed through the chimney. The house heating boiler has to run between a wide range in its rate of combustion and the manufacturer has to make a boiler to suit average conditions, and he can give as good results with a water leg as with a fire brick fire pot. At a low rate of combustion the fire-brick fire pot has an advantage, but a boiler is only run at a low rate of combustion for a small part of the season.

MR. HART: While there might be a saving in using gas for heating purposes during eight weeks of the heating season, I do not think there is any interchangeable grate that can be readily installed without considerable expense.

VIEWS OF GEORGE S. BARROWS.

MEMBERS OF COMMITTEE ON UTILIZATION OF GAS APPLIANCES, AMERICAN GAS INSTITUTE.

We of the gas companies are very anxious to put in what are called all-gas kitchens, that is, to equip kitchens so that there shall be no coal range. It is entirely practicable to do this if the kitchen is

heated. But if the kitchen is only heated by means of the ordinary gas range, which is a very inefficient heater because it is constructed to conserve as much heat as possible, the gas bills will run up pretty rapidly. Manufactured gas for heating at the present prices will not compete with coal unless one is willing to pay something for cleanliness and convenience. I am speaking now of manufactured gas, costing around 80 cents per 1,000 cubic feet, as compared with hard coal at $6.00 to $6.50 per ton. The gas-heated steam radiator is being considered for use in kitchens, but in all probability the most desirable means of heating the kitchen is from a boiler fired with coal and placed in the cellar, the heat in the kitchen being obtained by radiation from a suitable radiator in the kitchen and in series with the ordinary domestic supply of hot water.

Regarding an efficiency with gas heating of 90%, I think one would have difficulty in obtaining that percentage. The flue products must go off at a high temperature unless a fan is installed. When burning gas perfectly there is no carbon monoxide, but the water vapor and the carbon dioxide in the products of combustion are constantly heavier than the air and they will only rise so long as they are kept at such a high temperature that they will be lighter than air.

One of the things that has curtailed the use of gas fires in London in buildings four or five stories high, is the blanketing effect of the products of combustion which are cooled before they get out of the chimney. In a two or three-story house gas heating is used very successfully. Particular attention must be paid to that. The products of combustion must pass from the heating device at a fairly high temperature and, therefore, a relatively large amount of heat is lost by convection.

The average circulating water heater in use today operates at an efficiency of about 60% and the average instantaneous heater at an efficiency of about 75%. With a properly-designed device it may be possible to get a somewhat higher ratio than that, but probably 80% is about as high as can be obtained.

In the Spring and Fall there is available a larger amount of gas heating by means of auxiliary heating appliances placed next to the boiler or heater than we realize. These main appliances, being coal-fired, are allowed to go out, say the middle of April, and the gas-fired auxiliary plants are then started up and burned for a half hour or hour in the morning and evening, when necessary, or even turned on for a day or two at a time during a cold spell. Where gas sells for $1.00 per 1,000 cubic feet, it is about as cheap as coal for such short periods and much more convenient. In St. Louis, it is said, there are about 200 buildings heated by gas, the price of gas in that city on a sliding scale being 60 cents. Compared with cheap river coal the average cost of gas heating is from two to three times that of coal, but it is being used by all classes of consumers on account of the cleanliness and convenience.

When I went into Kansas City, I went to a city where natural gas was unknown. The gas company wanted to build up a business quickly, and I spent several months traveling around different parts of the country to find out the best practice in natural gas. We took the best and then improved a little on that. From the very first we told our customers not to put in only natural gas furnaces. We were bringing the gas 125 miles. The pressure varied from 300 pounds in the field to 5 pounds in the city high pressure mains. The average consumption, we will say, of the ordinary city residence, would be at the rate of about 30 cubic feet per hour in mild weather. That would go up to 180 cubic feet, possibly 200 cubic feet, during a cold snap, and this sudden demand simply meant that the people were using more gas than could possibly be supplied, so that somebody had to go without gas as a fuel. Also, there might be a break in the high pressure line, stopping for a short time all the supply. For these reasons we told everybody that they should always have some sort of solid fuel on hand to burn in a furnace in which gas might be burned as well.

It took a great deal of experimenting to decide on the best type of burner to give the best results, and we only put them in after very carefully conducting tests to be sure that we were getting no CO. As we were getting very little excess oxygen and a relatively low flue tempera-

ture the efficiency of the burners was high. We were obtaining at our large power plant boilers of say 4,000 horse power, about 70% efficiency, and that was with leaky settings. Without domestic burners also we were undoubtedly getting high efficiencies.

We knew that gas at 25 cents per 1,000 cubic feet, compared with a very high grade of semi-anthracite coal at $7.00 per short ton, or anthracite coal at $9.00 per ton, so that we were saving from 25% to 30% by using gas, and in some cases more than that. We had a locomotive boiler on a temporary job, used to supply steam for air compressors. We burned the gas in a regenerative chamber using the radiant heat from the fire brick before putting the products of combustion through the flues. The results were so satisfactory that we were led to think that probably we could use the same sort of fire-box chamber in the ordinary house-heating appliance, so we put those fire-brick chambers in hot water and steam boilers, as well as in hot air furnaces, and got the best possible results. It was a little difficult for the consumer to take out the fire brick chambers if he had to change quickly to coal, but as time went on we found ways of putting in the bricks so that they could be hauled out in perhaps half an hour. It took, perhaps, two hours to build them up again, when it was desired to change back from coal to gas. The greatest care must be exercised to put in proper burners, but I do not believe there is a furnace built that cannot be heated just as well with gas as with coal, but you have to hunt around a great deal in some cases before you get the right burners.

O. J. KUENHOLD: In speaking of gas furnace efficiency, I think we should regard as a loss the heat in the gases going up the chimney either as unburned gases or as sensible heat, and assume that all the heat that is radiated into the basement is gain, providing that the heat radiated into the basement is not excessive. When I spoke of 90% efficiency of the gas heater, I referred to the efficiency achieved in that way. Of course, with power boilers it is different, for you can only figure the actual output of the boiler into the steam main, and you figure the radiation from the boiler as a loss.

The Relation Between Temperature and Relative Humidity and Its Bearing on Comfort

BY VERNON HILL, M. D.

VENTILATING INSPECTOR IN CHARGE, DIVISION OF VENTILATION, CHICAGO DEPARTMENT OF HEALTH.

It is a well-known fact that in school rooms and auditoriums, when artificial heat is employed, the comfort of the occupants depends to a considerable degree on the amount of moisture in the air, as well as on the temperature. In other words, there is a direct relation between the temperature and the relative humidity in its bearing on comfort. While this is generally known, it is not so well understood what this relation is and how the percentage of relative humidity should vary with changes in the dry bulb temperature to obtain the most satisfactory results from the standpoint of comfort.

Professor John W. Shepherd, of the Chicago Commission on Ventilation, made a series of tests in the experimental room of the Chicago Normal College in 1912. These experiments extended over a period from January 1 to April 1 and covered a total of 154 tests. I know of no work on this subject that has been done in so careful and painstaking a manner.

The results are tabulated in the form of a chart on which the relative humidity is plotted as abscissae, with temperatures in Fahrenheit as ordinates. The locations on the chart where a certain combination of temperature and relative humidity is warm, comfortable, cool, etc., are designated by suitable symbols. (See Fig. 1).

The information obtained during these experiments is of considerable value. The chart, however, has not received the recognition it deserves, on account, I believe, of the way the information is presented. If, however, you draw lines through the points indicating the boundaries of the zones where it is too warm,

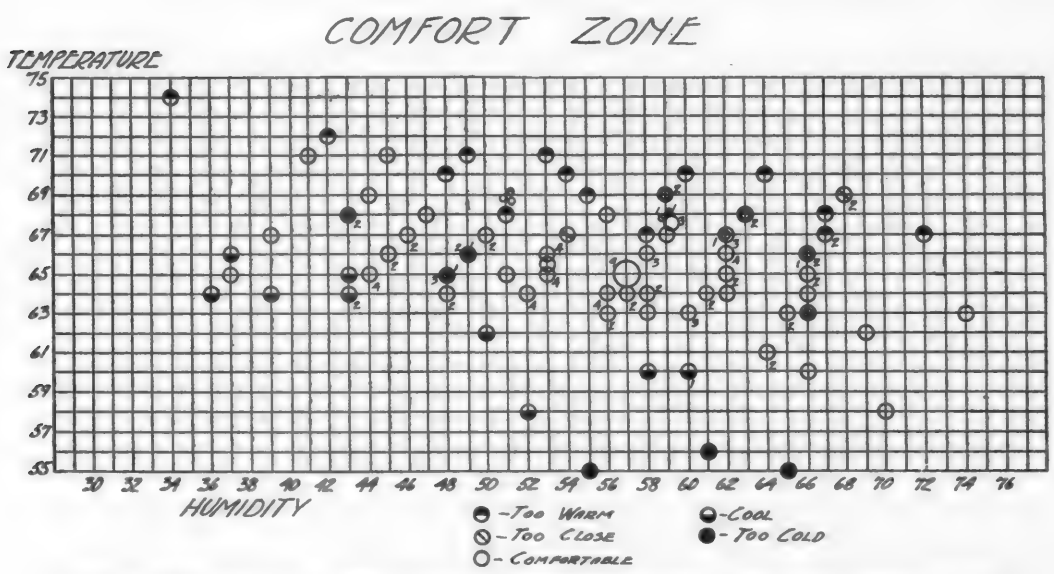

FIG. 1.—TEMPERATURE AND HUMIDITY CHART REPRESENTING MOST COMFORTABLE COMBINATIONS OF HEAT AND MOISTURE BY TEST.

comfortable, cool, etc. (Fig. 2), we will obtain a chart giving a central zone which will correspond to the "Zone of Comfort." Above this will be a region where it is too warm; below, another where it is cool. Any point may be selected in this "Zone of Comfort" and the temperature and relative humidity read from the borders of the chart. In this form it may be used for reference in determining the humidity which it is desirable to maintain at any temperature within the range of these observations.

Studying the chart a little further we find that it is possible to draw a straight line (see dotted line in the "Zone of Comfort" in Fig. 2) through the center of this comfort zone and evolve a formula

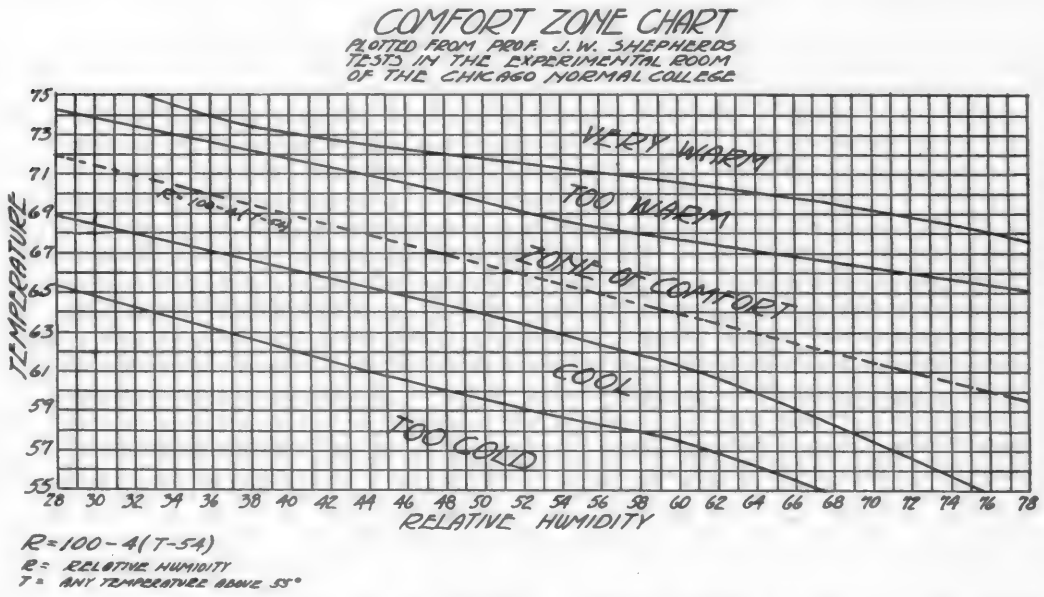

FIG. 2.—COMFORT ZONE CHART BASED ON TESTS SHOWN IN FIG. 1, ARRANGED FOR EASY REFERENCE FOR DETERMINING PROPER HUMIDITY WITH DIFFERENT TEMPERATURES.

which will give the relative humidity for any temperature. This formula is:

R=100—4(T—54) in which

R=relative humidity

T=any temperature above 55° F. and within the range of the chart.

Example: What relative humidity will be comfortable at a temperature of 68° F.?

Solution:

68 (T) —54=14
14 × 4=56
100 — 56=44

Answer, 44° F.

The fact should not be lost sight of that the range in relative humidity which would be comfortable at a given temperature extends for probably 10% above and below the value of R. It should also be noted that the application for the formula does not hold good beyond the range shown on the chart.

Odors and Their Composition.

Following is the full text of Prof. John R. Allen's remarks at the recent meeting of the Heating Engineers' Society on the subject of odors:

"I have consulted with our physiological and psychological departments at the University of Michigan and I am informed that there is no instrument known by which you can absolutely measure odors. The ordinary way to measure them is by an 'olfactometer,' which is the human nose, and that is more or less inaccurate. It has been stated that ozone acts by oxidizing the odors. Now we do not know what causes odors. We talk about the fine distribution of matter. When you come to radioactive materials and think of the infinitely small amount radiated from them as compared to the energy that is given off; when you come to study smells such as the odor that is given off by a piece of sandalwood that has been giving off an odor for 2,000 years; when you come to consider how small must be the particles that have been given from that sandalwood during all that period and that it is still giving off particles sufficiently powerful, however small they are, to affect the olfactory membrane, you will see that you are dealing with a very difficult subject.

I do not think it is possible at the present time to tell whether we oxidize odors or not, because we do not know the chemical composition of odors. We are dealing with too minute particles to be able to analyze them, and the question arises in my mind whether after all the ozone, as a matter of fact, does act by oxidization. It is quite probable that it acts by what is called "olfactory compensation." It is a well-known fact that you can compensate one odor with another. Take, for instance, deodorized iodoform which has in it some material which neutralizes, so far as the mucous membrane is concerned, the smell of iodoform. The smell is there just the same, but the other smell deadens it, so that, as far as your nervous system is concerned, it counteracts it. It is probable that the action of ozone in the cases mentioned in the paper is simply through olfactory compensation.

A Reply to Recent Comments on Air Ozonation.

CLOSURE BY MILTON W. FRANKLIN, WHOSE PAPER ON "AIR OZONATION" WAS PRESENTED AND DISCUSSED AT THE RECENT SUMMER MEETING OF THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS.

I have read the discussions of my paper by Professor John R. Allen and Professor J. D. Hoffman, and also the extracts from Professor Frederick S. Lee's paper which was read at the meeting.

Professor Allen questions whether ozone destroys or only masks odors and states that our knowledge of odor is so limited that we probably are not in a position to make any definite statement on this subject. I think I can show that we are justified in stating unequivocally that ozone destroys the odors and does not mask them. In the first place, it may be assumed with reason that we are not gifted with two senses of smell: one for those chemical compounds whose formulae are not definitely known and one for those other chemical compounds whose formulae are definitely known; and, therefore, if the odors of the compounds of known composition are demonstrably destroyed by ozone the disappearance of the odors of unknown composition under similar circumstances is also due to destruction and not "olfactory compensation."

Secondly, it may be assumed that if a certain substances gives rise to the sensation of smell; if this sensation of smell disappears on the admixture of ozone with this substance; and if this substance is chemically converted by ozone into an entirely different substance having no odor, then the ozone has destroyed the odor and not the sense of smell. Hence, if it can be shown that in the case of chemical substances of known composition, ozone destroys the odor, it is entirely reasonable to conclude that the disappearance of odor with ozone in substances whose compositions are not so well known is an indi-

cation of destruction and not of "olfactory compensation."

Numerous tests which prove destruction of certain odors by ozone are available but I will refer to only the latest, namely, those of Professor J. C. Olsen (HEATING AND VENTILATING MAGAZINE for July, 1914). Professor Olsen has shown that hydrogen sulphide, ammonia and clove oil (eucaine) are definitely destroyed by ozone and chemically converted into other substances which are without odor. Therefore, I feel justified in stating that where an odor is caused to disappear through the agency of ozone, this odor is destroyed and not masked.

EFFECT OF OZONE ON QUICKSILVER.

An example of such a chemical reaction is that between quicksilver and ozone. Quicksilver is a bright mobile liquid of great mass and of silvery color and luster. Ozone is an invisible gas which manifests itself to our senses only by its odor. These two substances are practically totally dissimilar. But when they are allowed to come into contact as, e. g., when a stream of ozone passes over a surface of mercury, it is found that the ozone and also the quicksilver disappear and in their place is left a black dense powder, the oxide of mercury. This latter bears no resemblance physically or chemically to the two substances from which it was formed, but is very much like what lamp black would be if it became very much heavier. It is neither liquid, gaseous, silvery, bright, nor invisible and odorous, qualities possessed by one or other of its forbears; in other words, it is no longer mercury nor ozone nor yet a mixture of the two, but a totally different substance. Precisely the same change takes place when ozone combines with hydrogen sulphide. Both these substances are odorous gases but the results of their union are water and sulphur, a colorless liquid and a yellow solid, both without odor or taste.

Furthermore, the methods of the tests which I conducted and to which I have alluded precludes the possibility of "olfactory compensation" being mistaken for odor destruction. The ozone was added to the odors in bottles and the excess ozone destroyed before testing the effect, so it is certain that whatever action the ozone exerted was on the odor and not on the nose. This is especially convincing in view of the fact that it is in accordance with sound, chemical theory and that all evidence which has been cited as supporting the opposite view may easily be shown to be based on faulty experimental procedure and unsound deduction. There is no reason to believe that although the odors of ammonia and of hydrogen sulphide are destroyed by ozone, the odor of decayed perspiration, for example, is only masked by ozone.

Professor J. D. Hoffman quotes several lines from my paper and takes exception to them. I stated that the only baneful factors in vitiated air are heat, moisture and odors; that the available oxygen is in excess of the demand and that the CO_2 is harmless in concentrations likely to be met with; that the existence of "crowd poisons" is generally discredited; that bacteria as a menace in vitiated air are no longer seriously considered; and from these premises I deduced the conclusion that the modern practice of ventilation is concerned only with the absorption of heat, moisture, and the destruction of odors. In a paper presented at the Fourth International Congress on School Hygiene and published in THE HEATING AND VENTILATING MAGAZINE, Vol. X, Nos. 10-11, I gave a review of most of the important work that has been done on ventilation up to this time. All of the work which I cited was based upon experimental evidence by some of the best authorities in the world on bacteriology, physiology and sanitation and I can say that so far as such published data might be accepted, the opinions which I above enumerated are demonstrated facts. Whatever belief to the contrary may exist seems to be only in the minds of people who simply hold the opposite view, through innate conviction. The opinions of those who have made careful statistical observations and who have experimented in the laboratory seem to be almost without exception in accordance with those views above enumerated. It is evident that facts of a medical and hygienic character are never definitely proven, but in forming an opinion on which to base a conclusion we are safer in accepting the vast preponderance of opinion amongst actual experimenters than in merely following our own unsupported convictions. These views which I have expressed may or may not be correct, but there is much evidence in support of them and virtually nothing to their discredit; therefore, in the absence of better information I am forced to accept them.

REINSPIRATION OF EXPIRED AIR.

Professor Hoffman questioned whether respired air, freed from moisture and odors, and cooled, would be suitable for reinspiration. I would refer him to the recent paper by Doctor J. D. Crowder, sanitary expert of the Pullman Company at

Chicago, for a most painstaking and scientific dissertation on this subject. According to Doctor Crowder, the air might be reinspired any number of times, providing enough fresh air is added to keep the CO_2 vapor tension below the critical point and to supply the oxygen actually consumed. I certainly think that of two men confined in a close space, the one with the acute sense of smell would suffer more than the one in whom this sense had been lost. Heat and moisture are most certainly baneful factors in room air when they exist in such quantities as to prevent loss of heat and moisture by the human body and the air is the only method of escape for the heat and moisture produced in the body. Professor Hoffman seems to have understood that I believe that there are "crowd poisons" in air, but I endeavored to point out that I do not hold this view, as will be evident on carefully reading my paper.

BACTERIA IN EXPIRED AIR.

Regarding the existence of bacteria in expired air, I would refer to Professor Chapin's classic work on this subject (Modes and Sources of Infection). Professor Chapin is, perhaps, the foremost authority in America on the subject of epidemiology and his view in common with many other eminent authorities is that there is no air-borne infection.

With respect to the use of a very small amount of ozone in ventilation, I fully agree with Professor Hoffman, and our greatest difficulty has been in persuading people to use a sufficiently small amount to get results.

Regarding the quotation from Professor Frederick S. Lee's paper, it can be said that Professor Lee's opinion is frankly based on the work of the authorities whom he quotes and not on any observations or studies of his own. The experiments which he cites showed that ozone, strong enough to produce sterility in cultures, would prove extremely injurious to occupants living in the room, such as guinea pigs. This is true, but, as I have mentioned in my paper, no known method of room disinfection can be practiced in the presence of occupants. Furthermore, Jordan and Carlson's paper and those of Professor Olsen, myself and numerous other observers have shown that ozone most certainly will reduce the bacterial content of the air, even when in such small quantities as to be easily and comfortably respirable.

The conclusions with respect to the action upon the heart and nervous system that Professor Lee quotes from Jordan and Carlson are entirely negatived by their own statement that all the effects are due primarily to the local corrosive action of the ozone on the mucous membranes of the lungs. Translated into lay language, this is a confession that ozone has no specific poisonous action whatever, but that when it is used strong enough to inflame and corrode the linings of the lungs there will result other secondary symptoms precisely as would be the case if the irritation had been caused in the first place by sulphurous acid, hot steam, or even pure oxygen. Regarding his opinion as to whether ozone should be used to destroy odors because of the question as to whether ozone destroys or only masks odors, I think that I have already disposed of this question.

The Pent Houses for the Ford Motor Company's Machine Shop.

In the description, published last month, of the heating and ventilating equipment in the new machine shop of the Ford Motor Company, in Detroit, it was stated that the heating, cooling and purifying apparatus consists of eight separate units located in pent houses on the roof. An idea of the size and arrangement of one of these pent houses is given in the accompanying illustration, which shows also the air duct leading from the pent house to the building columns through which the air passes out into the rooms.

Each pent house, as stated, contains a No. 12 Sirocco, left-hand, bottom horizontal discharge fan, being 10 ft. 7½ in. high, 4 ft. 10 in. wide and having an outlet area of 27½ sq. ft. The fan-wheel is 6 ft. in diameter and 3 ft. wide. Each fan draws through the air purifier and heater coils and discharges into the duct and hollow column system 56,000 cu. ft. of air per minute.

This duty requires a 40 H. P. motor for each fan, and when it is understood that each heater consists of nine sections deep of 72 in. Vento coil placed two stacks high and that the Sirocco air purifiers used are each 11 ft. 2 in. high, 12 ft. 1 in wide, and 10 ft. 3 in. long, the need for so large a pent house for each unit will be seen.

In Fig. 2 is shown the interior of one of the pent houses taken while the Vento heater was being set up.

American Society of Sanitary Engineers.

In accordance with action taken at the ninth annual meeting of the American Society of Inspectors of Plumbing and Sanitary Engineers, held in Minneapolis, Minn., August 25-27, 1914, that organization will hereafter be known as the American Society of Sanitary Engineers.

FIG. 1.—ONE OF THE EIGHT PENT HOUSES ON THE ROOF OF THE FORD MOTOR COMPANY MACHINE SHOP, DETROIT.

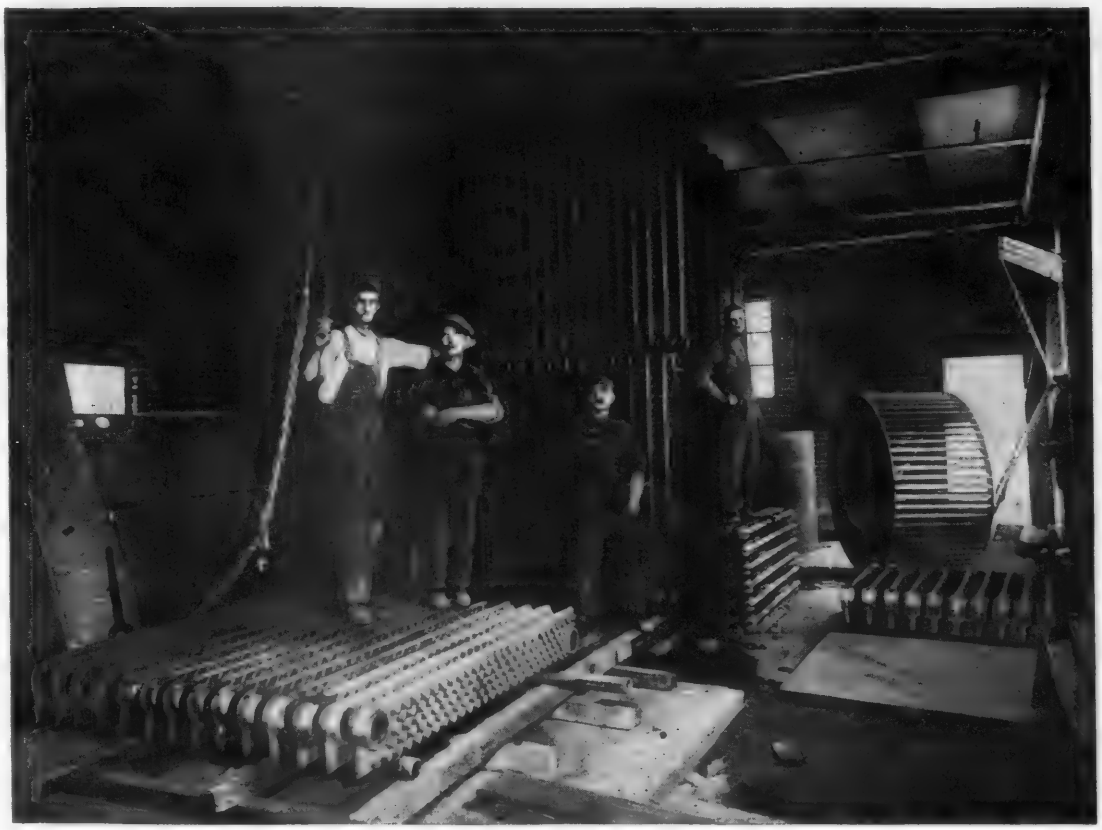

FIG. 2.—INTERIOR OF ONE OF THE PENT HOUSES, FORD MOTOR COMPANY MACHINE SHOP, SHOWING VENTO HEATER BEING SET UP.

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TO THOSE not living in the natural gas sections of the country, the use of gas for heating buildings is more or less of a novelty. Yet its possibilities as a fuel during the milder winter periods, in conjunction with a coal-burning heater, open up an interesting field for discussion. It has recently been shown, for instance, that the small use which is made of the ordinary heating plant in office and similar buildings during the beginning and latter periods of the heating season, is accompanied by an excessively costly steam production during such moderate periods of usage. In one case, that of a seven-story business building, the evaporation per pound of the fuel from and at 212° F. fell from an average of about 8.3 lbs. at the beginning of March to a low point of 0.7 lbs. of water per pound of coal in the last week of the observations, ending May 16. This meant that the efficiency of the boiler declined from an average of 64% to 18.5% and, during the last week, to 5.5%.

By arguments based on these figures it was shown that if manufactured gas had been used in place of coal during the milder periods, at a cost of 80 cents per 1,000 cubic feet, and assuming an efficiency of evaporation of 90%, a substantial saving could have been effected. The observations, it was stated, appear to demonstrate that even at the price of 80 cents per 1,000 cubic feet, manufactured gas could be utilized economically for building heating purposes over a period of about 16 weeks. As the total heating season is 32 weeks, these conclusions would apply to no less than half of the heating season.

THE soundness of the theory, however was shown to depend almost entirely on the efficiency of evaporation obtained with gas. Owing to the fact that high flue temperatures are necessary to carry away the products of combustion, the possibility of securing as high an efficiency as 90% may be seriously questioned. But even at a lower efficiency the proposition would seem to merit attention, especially since the idea has been advanced by more than one gas heating expert that it is feasible and practicable to arrange any of the usual types of heaters so that they may be readily changed from coal-burning to gas-burning heaters.

We are fortunate in being able to present in this issue a fairly extended discussion of this subject which took place at the summer meeting of the heating engineers' society, with the remarks of each speaker carefully revised. One of the speakers tells of a unique method that was successfully adopted for using either coal or gas in a boiler. Incidentally, the discussion gives an added usefulness to the weather charts, published for several years in our columns during the heating season, in showing the extent and probable dates of the "mild" periods throughout the heating season.

THE CONSULTING ENGINEER

The Consulting Engineer" is prepared to reply, in this department, to any questions which our readers may ask regarding problems connected with the design and installation of mechanical equipments of buildings.

36—Corrosion and Scale in Hot Water Supply.

QUESTION: I shall be very glad indeed if you can see your way at an early date to deal with the different qualities of water one meets with in practice, *i. e.,* in this connection I would ask you to give an analysis of the water supply in connection with which you would consider it necessary to use copper circulating pipes for a domestic hot water supply, also direct and indirect systems with galvanized pipes where the water is liable to deposit scale in the boiler. Another interesting problem which arises is exactly how far we may go with a certain type of water to be used in a wet air filter before specifying copper plate and fittings instead of the cheaper galvanized iron fittings. I feel that details of this kind are interesting to a very large number of heating engineers who do not happen to be well informed on this particular subject.

ANSWER: The analysis of city water supply to determine the impurities has very little to do with corrosion. The pipe stands up the best when the iron or steel is pure or has a minimum of impurities. This is the basis of all rust-resisting metals, such as "Toncan" and many others, known by trade names. There is a very interesting book on this subject published by the American Ingot Iron Co., which can be obtained upon application.

It is the impurities in the steel and iron combined with the air in solution in the water which causes corrosion. The only metal that will resist this is copper or brass. Iron galvanized will be of questionable life, and the whole problem is whether it is better policy to replace the metal oftener with lower first cost or to provide brass or copper at a very high first cost, with longer life.

In the case of an air washer, since the water is sometimes heated and contains a large amount of air in solution, there is no question about the short life of galvanized iron, but few will go to the expense of using copper. It can be stated as a general rule that the impurities in the water have little to do with corrosion. They do, however, involve the deposit of scale where salts of the alkaline earth occur and are generally precipitated by heat or by the addition of chemicals in a receptacle before entering the piping system.

37—Hot Water Radiators on Boiler Level.

QUESTION: When hot water radiators are set on the same floor level as the boiler, will you kindly tell me the efficiency of same and how much larger, if any, it is good practice to have them than a radiator on the first or second floor above. I am referring now to a radiator set in the basement on the same floor with the boiler. Is it important to have a loop in the supply pipe to get a good circulation? In THE HEATING AND VENTILATING MAGAZINE for August, 1913, you published a chart, entitled "Water Radiation by Carpenter's Rule." Is it to be assumed that to this is to be added the usual 30% for leakage and also the different percentages for different exposures?

ANSWER: Any radiator operated as described would have to be figured on the same basis as the water returning from the heating system to the boiler or at the minimum temperature. There is no reason, if the pipes are of ample size and a loop put in the supply, why it would not work satisfactorily. If the radiator can be placed on the ceiling of the basement near the top of the boiler, although in a less advantageous position, it would be more certain of results. In all of the commonly-used radiation formulas, if the factors for leakage and exposures are not specifically given, they are to be added to the results. In the chart referred to, the curves do not includes these items.

38—Modulation System for One-Pipe Heating.

QUESTION: I am interested to know whether the arrangement of modulation system for one-pipe, down-feed piping has been successfully and extensively used for residence heating. If successful, it would appear to have all the advantages of the two-pipe system and some of its own, with, I presume, the single exception that for this arrangement it would be necessary to use an automatic air valve on each individual radiator. Is this correct?

ANSWER: There is no reason why a modu-

lation system will not work in the manner indicated, provided the return leg is of sufficient length to overcome the maximum difference in pressure between that in the radiator and riser under all conditions under which the modulating valve is operated. The writer does not believe the overhead system has been extensively used for residence work, as this class of buildings is seldom over two or three stories high and few risers have more than one radiator. From an engineering standpoint, there is no objection to this design, excepting that where a modulating valve is used there might be a considerable difference in pressure between that in the radiator and riser, requiring a long return leg which might be just as well carried to the basement direct to the return main.

Proposed Engineering Bureau for New York City Board of Education.

The establishment of a new bureau of engineering to have charge of all engineering matters in connection with the operation of the public school buildings in New York City, and with a mechanical engineer at its head, will shortly be accomplished, if the Board of Education, as is expected, acts favorably on the proposition. Owing to the fact that the departmental budget for the city must be made up at once it is expected that definite action will be taken in time for the inclusion of the appropriation in the burget. The matter was discussed at length at the meeting of the Board of Education, Sept. 9, but no announcement was made of the action taken at that meeting.

The matter of a supervising bureau to have charge of the operation of the mechanical apparatus in the different school buildings has long been advocated. At the annual meeting of The American Society of Heating and Ventilating Engineers in 1912, a resolution was adopted petitioning the New York City Board of Education "that arrangements be made whereby the supervision of janitors and engineers operating ventilating plants, supervision of repairs, supervision of plant operation and supervision of fuel supply be placed under the control of the department designing such plants."

Since then the New York Chapter of the heating engineers has gone on record as favoring some such action.

In a review of the situation published in the Merchant Plumber and Steam Fitter, it is stated that at the present time there are three bureaus exercising some control over janitors, but the engineers who design and install the apparatus operated by the janitors have absolutely no control over the operation of such apparatus, and the staff of the supervisor of janitors is inadequate to compel proper operation thereof.

Also, in the matter of design and installation and maintenance of the engineering features of our schools there is ruinously divided authority, in that:

First, these purely engineering matters are controlled by an architect, and naturally enough are viewed from an architectural, rather than from an engineering standpoint, and the best judgment of the engineers is therefore overruled in many cases.

Second, the designing engineers, nominally in charge of their respective special branches, in addition to being subject to the superintendent of school buildings as to design, are also subject to the several respective deputy superintendents of school buildings as to installation, and have absolutely no control (except in Manhattan only) of the repairs and betterments of old plants.

Third, inspectors nominally assigned to the several divisions are responsible to and under absolute control of the respective deputy superintendents of school buildings for the respective borough to which they are assigned, and the chief of division has no way to control such inspectors.

These conditions lead to constant conflict of authority between the heads of divisions and the deputy superintendents, and the contractors often try to play off one authority against the other, or become discouraged by the conflicting orders received from the several officials.

With such conflicting jurisdiction there can be no proper handling of work or fixing of responsibility, and the chiefs of divisions cannot properly keep track of tests of new or special features or devices which it is necessary to try out.

Further, with architects in charge of the expenditure of the engineering repair and maintenance funds, such funds are not so likely to be wisely used as they would be under control of a head of division, expert in his special line, and in a position to handle such matters alike in the schools of all boroughs.

Moreover, the heating and ventilating, the electric and the sanitary piping lines and apparatus are vitally interdependent and tie into each other in such a manner that they need to be handled under one authority in order to avoid conflicts and unnecessary complications during installation.

SCOPE OF NEW BUREAU.

To overcome the above difficulties and to consolidate all purely engineering matters under one control, it is proposed to form a new bureau of engineering to care

for all matters that are purely engineering in their character.

This bureau should therefore have charge of heating and ventilating, electric and sanitary work, their design, installation, maintenance and operation, which therefore includes the appointment and supervision of janitors.

ADVANTAGES OF NEW BUREAU.

With all such engineering matters under the control of one bureau there would be closely fixed responsibility, avoidance of present conflicts of authority, ease of adjustment of conflicts of the several trades on the work, economy of inspection, and proper economical operation of plants in fulfillment of the purposes of the designing engineers.

Building Operations for the First Month of the War.

The fact that August, 1914, was the first month of the European war lends interest and significance to the figures of building operations in the United States during that period. These figures, as compiled by "The American Contractor," show the gratifying fact that new construction was entered into almost as fully as during the corresponding month of last year. The loss was 4%.

Seventy-two of the leading cities figure in the returns, the total value of building permits amounting to $54,335,465 as compared with $56,711,937 in August, 1913. Among the cities which showed notable gains are Cincinnati, Duluth, Jersey City, Newark, Brooklyn (New York), Paterson, Salt Lake City, Seattle and Worcester. Cities reporting losses include Cleveland, Milwaukee, Minneapolis, Oakland and Portland, Ore. The figures in Chicago were about the same as last year, $5,769,500; while the total for New York City, $11,288,654 was 15% higher than for August, 1913.

For the first eight months of the year the total cost of building permits issued in 72 cities totaled $490,561,593, as compared with $523,166,865 for the same month last year, a decrease of 6%.

Effect of Ventilating Systems on Room Acoustics.

In a report on the acoustics of auditoriums, based on an investigation of the acoustical properties of the auditorium at the University of Illinois, and published under the authorship of F. R. Watson as Bulletin No 73 of the Engineering Experiment Station of the University of Illinois, the writer has the following to say on the effect of the ventilating system on the acoustics:

"At first thought it might seem that the ventilation system in a room would affect the acoustical properties. The air is the medium that transmits the sound. It has been shown that the wind has an action in changing the direction of propagation of sound. Sound is also reflected and refracted at the boundary of gases that differ in density and temperature. It is found, however, that the effect of the usual ventilation currents on the acoustics in an auditorium is small. The temperature difference between the heated current and the air in the room is not great enough to affect the sound appreciably, and the motion of the current is too slow and over too short a distance to change the action of the sound to any marked extent.

"Under special circumstances, the heating and ventilating systems may prove disadvantageous. A hot stove or a current of hot air in the center of the room will seriously disturb the action of sound. Any irregularity in the air currents so that sheets of cold and heated air fluctuate about the room will also modify the regular action of the sound and produce confusion. The object to be striven for is to keep the air in the room as homogeneous and steady as possible. Hot stoves, radiators, and currents of heated air should be kept near the walls and out of the center of the room. It is of some small advantage to have the ventilation current go in the same direction that the sound is to go, since a wind tends to carry the sound with it."

John R. Allen on Radiator Tests.

The revised remarks of Prof. John R. Allen of the University of Michigan, on the subject of radiator tests, which were under discussion at the recent meeting of the Heating Engineers' Society, are as follows:

We have been carrying on radiator tests at the University of Michigan for about 20 years. Mr. Carrier is right in his statement in regard to the heat transmission through 2 col. cast-iron radiation which, we find, varies from 1.6 to 1.7 B.T.U., the average being about 1.67 B.T.U. There are many conditions that affect this factor. One condition that is often lost sight of is the fact that radiation depends upon the room itself. We formerly made our radiator tests in a room having no outside window. We changed to a room that had a large amount of window surface and found that the heat transmission through the radiator increases about 10%. A radiator loses heat in two ways, by convection and by radiation, and the radiation loss depends upon the temperature of the surrounding surfaces. If there are windows surrounding the radiator, the temperature of which is low, the radiation is

necessarily high and that increases the heat loss from the radiator.

In order to make an absolute comparison of radiators there must be a standard room in which to compare them. You must be certain that you have dry steam when making tests. In order to do that the steam is first superheated by passing high pressure steam through a reducing pressure valve and the heat of the superheat is allowed for in the tests, which is a matter of one or two degrees, and is a small correction.

It makes a difference whether the radiators are of the one, two or three-column type, and the spacing is also an important factor, as it affects the ease with which the air can pass along the surface. If you take an ordinary 2-col. radiator and increase the spacing one-half inch, you will increase the heat transmission about 10% through the radiator. So that, in comparing radiators, you should know approximately the air area between the surfaces in order to get an exact comparison.

The amount transmitted is slightly affected by the moisture conditions of the air in the room. As the moisture in the room increases, the heat transmission diminishes. Under extreme conditions the heat transmission will vary about 5%, depending upon the moisture in the room.

There have never been laid down any standard conditions for testing. This is one of the things that this society might properly take up: the establishing of rules for standard testing of direct radiators. Of course, each one of these factors is in itself small, but accumulated they show marked variations that would easily account for the differences we get in various tests. A standard room for such a purpose should be a room containing about the usual amount of window surface. If you test a radiator in a room with a standard amount of window surface and then test the same radiator in a greenhouse, you will get a very marked difference in the total heat transmission, running as high as 20%.

Novel Scheme for Advertising a Cool Theatre.

A leading Cincinnati vaudeville house which keeps open throughout the hot months and relies very largely for its patronage, at that time, on folks who would flee the sun-baked city streets or even the heat areas that remain with the evening in the parks, has mounted a unique little device in its lobby to catch the attention of these wilted passersby. This arrangement, which looks for all the world like one of the usual ticket boxes into which tickets are dropped at amusement gardens, stands boldy in the vestibule, just beside the ticket-seller's window. Its lower portion is enclosed, concealing the secret processes of manipulation, of course, but the

SCHEME ADOPTED BY CINCINNATI VAUDEVILLE THEATRE TO ADVERTISE ITS COOL INTERIOR.

upper portion consists of a box, fashioned of heavy glass. Just inside this box is a a large thermometer and the legend of the box tells the tale:

"Look at the thermometer and see the temperature inside the coolest theater in town!"

Just how the air currents from the inside of the theatre are kept circulating through the box out there, so as to counteract exterior heat, may be surmised, but the promise of a temperature inside 20° cooler than outside undoubtedly wins for the theatre many a patron who might otherwise have passed it by.

Economic Resources of the United States.

A partial inventory of the national assets of the United States in area, population and the fundamental factors of economic life reveals the fact that it is not only practically self supporting but that it possesses, in many lines, a large surplus available for protection against famine and temporary adversity or for use in meeting unusual demands from the outside world. Recently the Bureau of Foreign and Domestic Commerce has been receiving hundreds of letters from American producers and manufacturers making inquiries regarding possible markets abroad for their surplus products and as to the ability of the United States to supply the raw materials necessary to their industries. Investigations in connection with the replies to these inquiries have developed the fact that in many instances materials now imported from abroad are of a class found in this country, the production of which, however, is still in the initial stages. This is particularly true of numerous basic materials used in the chemical industries, which were formerly wasted, but are now partly utilized.

The peculiarly fortunate position of the United States in its ability to supply its own needs is clearly seen from a survey of its production and relative contributions to the world of the great requirements of man—food, clothing and shelter. It is found, for example, that the people of the United States may be readily fed by home produced foodstuffs, our vast area of 3⅔ million square miles representing every variety of climate and production and nearly equal in extent to all Europe with a population five times that of this country.

Agriculture in the United States has not yet reached the stage of scientific development common to many countries of Europe, and the present domestic production may therefore be expected to increase greatly with more attention to improved methods of culture. Nevertheless, our country already produces over 2½ billion bushels of corn, or two-thirds of the world's supply. This year's wheat crop is estimated at the high-record figure of 911 million bushels, about 20 per cent. of the world's harvest.

The United States also produces annually over one billion bushels of oats, or one-fourth of the international yield, and 197 million gallons of cottonseed oil, representing most of the annual output of this article, whose food value as a substitute for olive oil is becoming more and more recognized. Fifteen per cent. of the world's cattle are on American farms, the number in this country being 59 million, or twice as many as in Argentina or European Russia and half in number those of India. Our country also has 60 million swine, or three times as many as Germany; 50 million sheep and 24 million horses. We import, however, 5 billion pounds of sugar (chiefly Cuban), or one and one-half times the amount produced in continental United States and its island territories.

In clothing material the United States is also favored, producing annually over 14 million bales of cotton, a sum ten times that for India, and representing over one-half of the world's supply. Of wool we produce a little less than 300 million pounds a year, our home requirements being supplemented by 238 million pounds of foreign wool and 34 million dollars' worth of woolen goods.

In the mineral kingdom the pre-eminent position of the United States is unquestioned. We produce, for example, 534 million short tons of coal, 40 per cent. of the world's output, and nearly twice as much as the United Kingdom or Germany; 238 million barrels of petroleum, two thirds of the world's total, and three times as much as Russia; and 57 million tons of iron ore, out of a world's total of 132 million, the production in this country being twice that of Germany. One-half of the world's copper is taken from American mines, which turned out 1¼ million tons in 1912. Of the world's output of 466 million dollars' worth of gold, the United States produced about 20 per cent., being exceeded only by South Africa. About 28 per cent. of the world's silver and 30 per cent. of its lead are produced in this country.

In the value of manufactures the United States leads the world, though the product of American factories is chiefly consumed at home. Of the 20.7 billion dollars' worth of manufactures produced in the United States in 1909 only about 5 per cent. were sold to foreign countries, the world's market for iron and steel products, cotton goods, chemicals and other important products of industry being thus far largely held by England, Germany and other European nations.

The foregoing are indicative of the strong

position of the United States in its supply of the factors of national wealth, the details of which are found in the Statistical Abstract of the United States and various reports of the Departments of Commerce, Agriculture, and Interior.

The following table presents statistics showing a few of the great factors of our national wealth and suggests the foundations upon which a greater American commerce may be built up:

	United States.	Approximate Per Cent. Share of United States in World's Total.
Area .....square miles..	3,600,000	7
Population	102,000,000	6
Corn product .....bushels..	2,600,000,000	68
Wheat product.....do....	911,000,000	20
Cotton product .....bales..	14,000,000	56
Sugar product .....pounds..	3,995,000,000	10
Tobacco .....do....	791,000,000	35
Cattle on farms.....number..	59,000,000	15
Coal product .....short tone..	534,000,000	40
Petroleum product .....barrels..	238,000,000	63
Copper product .....pounds..	1,243,000,000	55
Iron ore .....long tons..	57,000,000	44
Gold product .....dollars..	93,000,000	20
Stock of gold.....do....	1,887,000,000	22
Value of all farm products.....do....	9,751,000,000	No data
Value of manufactures.....do....	20,672,000,000	No data
Imports in fiscal year 1914.....do....	1,894,000,000	9
Export in fiscal year 1914.....do....	2,365,000,000	12
Foreign trade fiscal year 1914.....do....	4,259,000,000	10
Domestic trade fiscal year 1914.....do....	40,000,000,000	No data
Railways .....miles..	259,000,000	38
Aggregate wealth, estimated.....dollars..	140,000,000,000	No data

Panama-Pacific Exposition on Scheduled Date.

In a statement sent out by Charles C. Moore, president of the Panama-Pacific International Exposition, the report that the exposition might be postponed on account of the European war or that the war in Europe might seriously affect the commercial or educational importance or the financial success of the exposition, is vigorously denied. The exposition, says the statement, will open on its scheduled date, February 20, 1915. It will also be completely ready when opened. It is more than 90% completed at present. Mr. Moore also states that not one of the nations at war has notified the exposition management of an intention to withdraw its participation, France and Italy having in fact sent word that their plans remain unchanged. As to the domestic participation, it is stated that the European war seems likely to be rather advantageous than otherwise. The stimulus on exhibits is already felt, as American manufacturers have become impressed with the opportunity given by the exposition for bringing their goods to the attention of the large distributors of Central and South America, the Orient and Canada.

As to attendance, expert opinions are to the effect that there is nothing in the situation, even if continued through 1915, that will affect seriously the willingness or ability of the people of the western hemisphere and of the Far East to visit the exposition. Some opinion is firm that travel to California may be increased by the war. The exposition, says Mr. Moore, promises to be the most important, the most beautiful and the most successful in history.

How Steam Pipes Cause Fires in Factories.

The report of a fire in the factory of the R. D. Fairbairn Co., Ltd., Chicago, being caused by a 2-in. steam pipe carrying steam at 40 lbs. pressure, has centered attention anew upon the necessity of protecting pipes of heating systems whenever they pass through a floor. A writer in the *Canadian Manufacturer* says that fires caused by steam pipes usually occur under conditions where the steam pipe is in contact with the wood of the floor itself or with some inflammable foreign matter which collects in the air space between the floor and the pipe.

When the wood is in contact with the pipe it becomes baked to the consistency of charcoal, in which condition a very slight increase in temperature will be sufficient to ignite it.

In any factory where fine dust of an inflammable nature is created there is a danger of the dust collecting around the steam pipes, where it forms a material which is very similar to the tinder used in the old flint and steel method of starting a fire, and which is easily ignited by a hot steam pipe.

The fluff from vegetable fibres that is present in cotton mills and factories for manufac-

turing cotton goods is especially dangerous in this connection.

Obviously, the remedy is to keep the pipe from touching the floor and to exclude all dust and other material from the air space around the pipe.

This is readily accomplished by the use of a sheet metal collar. The collar is made in two pieces, so that it may be placed on pipes already installed, but in new work a collar made in one piece will give better satisfaction. Being close-fitting, the collar keeps out dust and sweepings, and being nailed down it keeps the pipe from being moved over against the edge of the floor.

At least 1 in. clearance should be left between pipe and floor.

Current Heating and Ventilating Literature.

Under this heading is published each month an index of the important articles on the subject of heating and ventilation that have appeared in the columns of our contemporaries. Copies of any of the journals containing the article mentioned may be obtained from THE HEATING AND VENTILATING MAGAZINE *on receipt of the stated price.*

FANS — Centrifugal-Fan Characteristics. Frank L. Busey. Shows that the performance depends on the wise selection to meet the conditions. Ills. 2500 w. Power—Aug. 11, 1914. 20c.

LOGARITHMIC PAPER—Practical Applications of Logarithmic Paper. W. F. Verner. Explains in detail how to use logarithmic paper, and the method adopted in making charts to be used in connection with the flow of steam in pipes. 2500 w. Mich Tech—May, 1914. 40c.

PIER HEATING—Heating the Largest Pier in the World. Describes a heating plant designed to meet unusual conditions. Ills. 1500 w. Power—Aug. 11, 1914. 20c.

PIPING—The Elasticity and Endurance of Steam-Pipes. C. E. Stromeyer. Read before the Inst. of Nav. Archts. An inquiry into the causes of failures. 5000 w. Engng—June 19, 1914. 40c.

POWER LOSSES—Preventable Losses in Factory Power Plants. David Moffat Myers. This seventh article of a series considers the heating system and how the highest economy may be reached. 6000 w. Engineering Magazine—Aug., 1914. 40c.

New York School of Heating and Ventilating.

Continuing the series of evening lectures given last winter on heating and ventilating to a class of some 36 students, announcement is made that the course will be given again this year, the meeting place being Room 511, World Building, Park Row, New York. Charles A. Fuller, consulting engineeer with Clark, MacMullen and Riley, will again have charge of the course. In a printed announcement Mr. Fuller states that the first meeting of the class will be held November 2, 1914. The course will consist of 22 lectures, covering the subjects of heating and ventilating, with special reference to computation of heating surfaces, pipe sizes, boilers, etc., for gravity and vacuum steam systems; for gravity and forced hot water systems; sizes of ducts, fans and heaters for various kinds of ventilating systems; and purification of air and humidifying devices. The fee for the complete course is $10.

Competition for Design of Gas Fireplace Heater.

The American Gas Institute and the National Commercial Gas Association has authorized a joint committee on fireplace heater design to offer a prize of $150 for the best design of a fireplace heater, burning gas. The purpose of the competition is to develop more efficient types of gas heaters from the standpoint of heat production and at the same time meet the requirements of an attractive appearance when located in dwellings and to be in harmony with their surroundings. In the conditions as outlined by the committee, it is stated that the fireplace and flue should be designed and built with as much care as if a wood or coal fire was used. The competition will close March 1, 1915. Detailed information regarding the competition is being furnished to those interested by William J. Serrill, 1401 Arch St., Philadelphia, Pa.

Detroit Engineering Society.

At the meeting of the Detroit Engineering Society, September 11, which was the opening and house warming night of the society's new home and club rooms, the principal speaker was Prof. John R. Allen, of the University of Michigan, who spoke on "An Engineer's Experience in Turkey." Illustrations were shown of the people and customs of the people of Turkey where Prof. Allen was stationed for two years organizing the engineering department of Robert College in Constantinople.

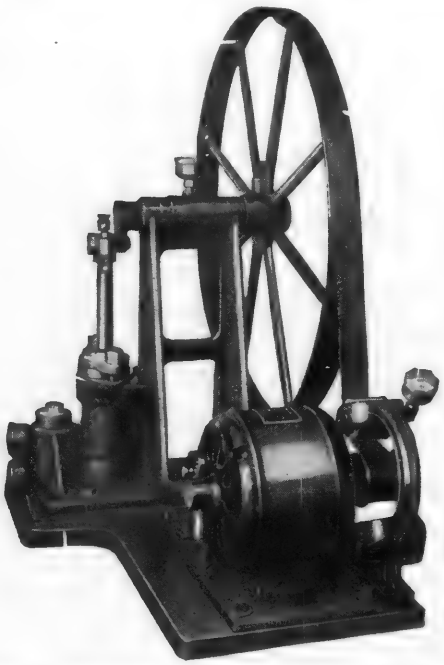
American Public Health Association.

The forty-second meeting of the American Public Health Association will be held in Jacksonville, Fla., Nov. 27-Dec. 6, 1914. In connection with this meeting there will be an exhibit to be known as the "Southern Health Exhibition," which will deal especially with health problems peculiar to the South and the advances made in that section in preventive medicine. The exhibits will include the work of State and municipal boards of health and of private and semi-public organizations throughout the entire South.

NEW DEVICES

New Design of Electric Vacuum Pump.

What is described as the most efficient and economical vacuum pump made for heating systems, having a capacity up to 4,000 sq. ft. of direct radiation, has recently been brought out by the Bishop-Babcock-Becker Co., Cleveland, O., under the name of the "Reliable" electric vacuum pump. It is especially designed for use with the "Reliable" air line vacuum heating



NEW ELECTRIC VACUUM PUMP FOR USE WITH RELIABLE AIR LINE SYSTEM OF VACUUM HEATING.

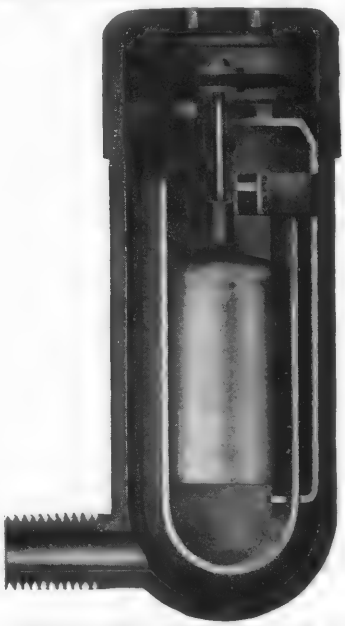
system. As will be noted from the illustration, the pump is belt-driven and is said to be not only automatic and noiseless, but so perfect in operation that the cost of electric current for operating it is from one-third to one-fifth that of many pumps accommodating the same amount of radiation. The pump is equipped with an electric motor of either direct or alternating current of 1/6 H. P. It is designed to start easily under full load and will operate on a voltage variation of 10%. The pump has but two valves, held in place by a phosphor bronze spring which insures easy operation and positive seating. The valves are easily accessible.

Considerable care has been shown in the materials used in the construction of this pump. For instance, the one cylinder, which is vertical and single acting, is made of iron cast in one piece with the stand. The piston and valve seats are made of bronze, while the main shaft bearings and pinions are of phosphor bronze. The base has a gutter in the form of a drip pan to keep the oil from the floor. The base is heavy iron, cast in one piece. The equipment furnished with the pump includes an automatic electro switch and vacuum controller, a strainer, expansion tank, vacuum gauge and flanged screw connections.

Converting a Gravity Steam Heating System into a Vacuum-Vapor System.

A canvass of architects and heating engineers has shown that not only have the old one and two-pipe gravity steam heating systems still many strong advocates, but that there is a tendency in many quarters to return to their use, due to economical installations and long life. This regardless of the economy possible in the operation of a vacuum-vapor system. This tendency has led to the invention and introduction to the trade of a new device or converter, known as the Koalsave vacuum air valve, which is designed to convert any steam heating system into a thorough and practical vacuum-vapor system.

This device is described as the first air valve to produce a perfect vacuum. It is of ingenious construction, pains having been taken to make its action positive and automatic. It is thermally and hydraulically controlled and pressure actuated.



KOALSAVE VACUUM AIR VALVE.

The functions of a perfect air valve, which this device is designed to perform, are to let air freely out of the system, to close against the escape of steam, to prohibit the entrance of air into the system and to prevent leaking. The additional point is made that while this type of valve gives all the advantages of a vacuum-vapor system, as far as economical heating is concerned, this system is obtained without the expense of installing special inlet valves, automatic traps, pumps or other auxiliaries.

The manufacturers state that the air valve is positively noiseless and fool-proof and eliminates, among other annoyances, the snapping and pounding of cold radiators due to air binding, and damage done to floors, sidewalks and ceilings through leakage.

In the construction of the valve the play between the shoulder of the valve disc stem and the hook on the thermostat-metal tongue is arranged to allow free expulsion of air. As the steam enters the valve the thermostat-metal tongue expands, releasing the disc, whereupon the disc is forced to the upper or steam seat, holding in the steam. As the steam pressure lowers, the outside air forces the disc down to the lower or vacuum seat, keeping out the air and forming a vacuum.

This valve is manufactured by the Koalsave Vacuum Valve Co., Park Row Building, New York.

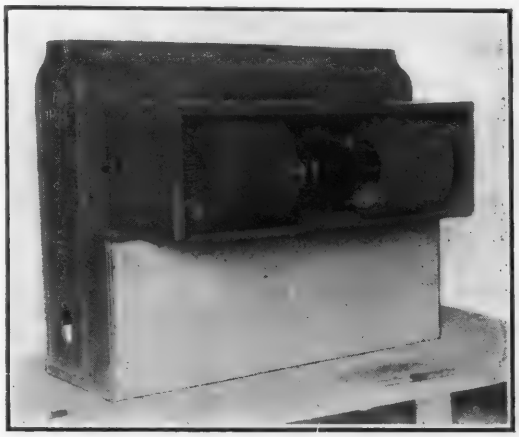
Multiple Unit System of Ventilation.

The extent to which the multiple unit system of ventilation is being adopted, especially in factories and school buildings, called renewed attention to this system which is manufactured by the Victor Ventilating and Engineering Co., Inc., New Brighton, N. Y. As will be seen from the illustration, the multiple unit system comprises a series of cabinets which completely enclose the radiators. Each cabinet is composed of a metal case for enclosing the radiator, and a motor and blowers for drawing fresh air from out of doors over the radiator and delivering the fresh, warmed air into the apartment in a condition suitable for breathing, and at a speed which sets up a condition of movement throughout.

The fresh air inlet is in the form of a cast-iron wall box set in the wall beneath the window sill. This may be installed during the construction of the building or inserted in old buildings, as the dimensions are such as to coincide with the layers of brick and the window sill without disturbing the latter or breaking up the various courses of brick.

Through the use of dampers fresh outdoor air may be used or the indoor air recirculated for rapid warming, if desired. The mechanism is so arranged that when outside air is used, the closing of the end door automatically opens the fresh air dampers in the wall box, a feature that is stated to be unique. Provision is also made so that the volume of air may be varied, as well as the amount of heat delivered. In addition the use of a water pan in the bottom of the cabinet serves to add moisture to the air, especially during recirculation.

The manufacturers have developed a machine which occupies the space ordinarily taken up by a four-column, 32-in. radiator. Its height is 32½ in., which is less than the height of the average window sill. It is stated to be unlike any similar product on the market in that it is not cumbersome, does not shut out light, gives ordinary access to the window for opening and closing



VICTOR VENTILATING UNIT, REAR VIEW, SHOWING ARRANGEMENT OF MECHANISM IN WALL BOX.

same, and presents rather an ornamental appearance in the classroom.

The mechanism of each unit is located in a motor blower housing, attached to a motor board, all of which is inserted in the cast-iron wall box. The advantage of this construction lies in hiding a large portion of the unit in the wall of the building, while it also gives ample support and foundation for the motor, besides enclosing the blowers in practically a sound-proof compartment.

In the installation of the multiple unit system, one unit is usually sufficient for a class room, and in very large or crowded rooms as many units may be used as necessary up to the number of radiators in the room.

As will be seen from the foregoing the system tends to create a plenum condition in the building. Ordinary methods of con-

ducting the foul air from the buildings are used with this outfit, either in the form of separate vent flues leading to the roof, as is required in New York State, or by having outlets in the doors to the halls, the foul air passing up the hallways to a vent outlet in the upper hall ceiling. The latter arrangement, by the way, is approved in the ventilating of schools in New Jersey.

The manufacturers announce that they have a fully equipped factory at New Brighton, N. Y., which is operating at its full capacity. Installations are at present in progress in a number of new and old buildings in North Bergen, Lodi, Fairview, Woodbridge and other towns in New Jersey. The company also states that the plans and specifications for this system have been approved by the Department of Public Instruction of New Jersey.

The officers of the Victor Ventilating and Engineering Co., Inc., are: President, George A. Collins, who is an engineer of 25 years' experience; vice-president, E. Rosedon-Foote, formerly a public accountant, efficiency engineer and factory specialist of the New York firm of Morison, Foote & Bull; and treasurer, Horace W. Bodine, trustee of the Edmund Bodine Estate.

A New Type of Automatic Air Pump.

A ventilator that has many unique features has recently been placed on the market under the name of the American standard automatic air pump and described as a revolving air pump without a down draft at any time. This feature of no down draft is easily attained with any ventilator when it stands before the wind, but the claim for the American standard device is that one may, with safety, turn the ventilator arounds so that the wind will blow directly through the vent outlet without getting a down draft.

This is explained by the statement that the wind in that case passes over the edge of the wind conveyor and follows a course through the wind conveyor under the inner hood and escapes at the inlet point of the wind conveyor and, therefore, never enters the base of the air pump.

The American standard air pump, shown in the illustration, is made with a perpendicular shell and revolves in a self-lubricated, pivoted ball-bearing, with its spindle well protected from the weather. It is also built to give the least rear wind resistance possible and to have the minimum of momentum. Another point mentioned for this ventilator is that its pulling power in lineal feet velocity is equalized throughout all sizes. On account of its steady upward pull at all times, it is particularly recommended for increasing the natural draft velocity of smoke flues, and as a sure cure for faulty chimneys.

In the accompanying illustration the air pump was erected on an elevator shaft of the High School of Commerce, near Broadway on Sixty-fifth Street, New York. The air pump is situated 4 ft. from the boiler smoke chimney which measures 4 ft. x 6 ft., and the wind conveyor is about 12 in. above the top of the chimney.

AMERICAN STANDARD AIR PUMP AT TOP OF ELEVATOR SHAFT OF HIGH SCHOOL OF COMMERCE, NEW YORK, LOCATED 4 FT. FROM BOILER SMOKE CHIMNEY.

The entire air pump, therefore, is enveloped in the gaseous fumes emitted from the chimney but has successfuly guarded the elevator shaft from any gaseous odors. It is the claim of the manufacturers that this is the only type of revolving ventilator that will prevent the gaseous odors emitted from this chimney from finding their way down the shaft.

The American standard automatic air pump is manufactured by the Century Ventilating Co., New York. The manufacturers state that it is specified by the New York City Department of Education for use in connection with the ventilating apparatus of the public schools.

A Modern Galvanizing Plant.

The new galvanizing plant recently completed by the A. M. Byers Company at its mills in Pittsburgh, which, with its installation, was designed especially for the Byers process, contains what is considered to be the most modern and efficient equipment for manipulating the galvanizing process known to the trade. This process, by which Byers' genuine wrought iron pipe is galvanized, is particularly thorough and of high standard, being similar in its hand-controlled methods to the other Byers' processes of manufacture. The Byers galvanizing specifications call for hot metal process, a coating of highest grade prime western spelter, and a deposit 100% heavier than that required in Government galvanizing specifications.

NEW GALVANIZING PLANT OF THE A. M. BYERS COMPANY.

The weighing and inspection before galvanizing, the device for turning the pipe in the baths, the extra long cleansing period, the pyrometer-regulated kettles, the quality and purity of the spelter, and the final weighing to assure the proper coating are the steps in the galvanizing process all of which have been specialized by the company's experts. The fact that Byers' genuine wrought iron pipe is used as a base material is stated to be in itself a guarantee of quality, as the spelter bites down deeply into its porous, uniform texture, coating thickly and evenly, and minimizing the possibility of flaking and assuring a maximum of life.

Trade Literature.

VALVES, VALVE DISCS, VALVE WHEELS, EXTENSION SPINDLES, etc., manufactured by J. O'Meara, Inc., 2 Lispenard street, New York, are shown and described in a newly-issued catalogue. The company states that in the manufacture of the discs for its iron body globe, angle and radiator valves, the same rubber compound is used which 25 years ago received the hearty endorsement of such firms as Gillis & Geoghegan and Baker, Smith & Co., of New York. All of the specialties shown in the catalogue are the invention of J. O'Meara, formerly chief engineer of the Union League Club, New York. A notable list of buildings is included which are equipped with O'Meara goods. Size 5x7 in. Pp. 8.

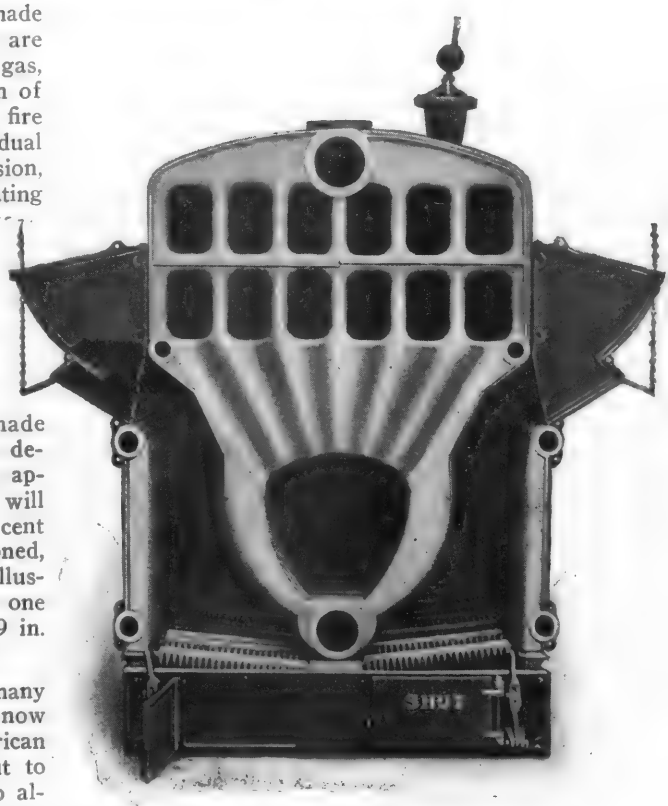
WING DISC FANS, MOTOR, TURBINE, BELTED, are treated in a new catalogue published by the L. J. Wing Mfg. Co., New York. An interesting feature of this type of fan, as pointed out in the catalogue, is the fact that the fan construction allows the blades to be adjusted to suit the conditions under which the fan is to operate. Each fan is, therefore, available for use under widely varying conditions, as the flow of air can be reduced or increased and also reversed without changing the direction of rotation. The manufacturer guarantees that the Wing disc fan and propeller type fans will move a greater volume of air per unit of power than any other fan on the market, size for size. The catalogue gives illustrations and price lists of the various regular types and a capacity and power table of Wing disc fans. Data on larger sizes, it is stated, will be sent on request. Typical buildings equipped with Wing fans are also shown. Under "Interesting Adaptations" are shown two installations of Wing disc fans, one on the roof of the Horton Ice Cream Co., in New York, and the other a 54-in. Wing disc fan exhausting air from the gas producer room in the basement, seven floors below, a feat which had at first brought forth the comment from some quarters that "it can't be done." In a list of users, almost every kind of manufacturing plant is represented throughout the country. Other products of the company, it is stated, are feed water regulators, positive pressure blowers, damper regulators and turbine blowers. Size 6x9 in. Pp. 20.

WROT IRON FURNACES for ideal warm air heating are announced in a catalogue issued by the Wrot Iron Heater Co., Des Moines, Ia.

As its name implies, these heaters are made of wrought iron instead of cast iron and are stated to be undeniably and permanently gas, smoke and soot tight. In the construction of this heater each section of the radiating fire pot hangs loosely but securely on an individual hook, a feature allowing for full expansion, yet forming a removable, jointless, radiating fire pot. The body of the heater is made of heavy gauge wrought iron boiler plate, so that there are no lengthwise riveted body seams or bolted cast iron chutes. Even the triangular bar dumping grate is made of wrought iron, making the grate bars practically unbreakable. In the equipment of this heater use is made of the Howard spray humidifier, which is described as the only artificial humidifying apparatus for moistening warmed air that will produce anywhere near the normal 65 per cent of relative humidity. The features mentioned, as well as others, are described and illustrated in detail in the catalogue, which is one of the handsomest of the year. Size 6x9 in. (standard). Pp. 16.

WAR MAP OF EUROPE, 19x26 in., giving many details and figures regarding the nations now at war, has been issued by the American Blower Co., Detroit, Mich., and sent out to the trade. The map is sufficiently large to allow the reader of current events to easily follow the general operations of the armies and its publication was a happy thought that is widely appreciated.

MOLBY HEATERS, DOWN DRAFT, for steam, vapor and water heating, manufactured under the Surrell patents are the subject of a new catalogue illustrating and describing this unusual type of heater. One of its most noteworthy features is that it burns the cheaper grades of fuel, pea coal or the larger sizes of anthracite (except furnace coal) and also burns soft coal, all without change of grates. It is made in two types, one with a magazine on one side only for small installations. For larger installations there is a magazine on each side of the boiler with a double fire. In mild weather only one side of the boiler need be fired. The Molby down draft heater is built entirely of vertical cast-iron water sections, connected by slip nipples. These water sections, presenting a large heating surface, extend until they rest on the center of the base, forming between them a combustion chamber. Through interstices or slots made in them they form a water grate also, through which the gases escape. A water front or leg section on each side, together with the end sections of the boiler, and the water grate, enclose the fire-pot. The magazine to hold a 12-hour supply of fuel is built above the fire-pot. The draft is taken at a point where the



END VIEW, WITH FRONT SECTION REMOVED, OF MOLBY DOWN DRAFT HEATER.

fire-pot and magazine join. The draft passes down through the fire and escapes with the high-tempered gases through the water grates into the combustion chamber, where, mixing with the flaming heat, they are consumed. These products of combustion are focused on the large area of heating surface and absorbed, gaining an efficiency stated to be 90 per cent. In the company's guarantee it is announced that "where installations are made under conditions as given herein, we guarantee them (our boilers) to carry their ratings in accordance with our tables and notes on ratings." The boilers are made in three series each for steam and water. Size 4x8 in. Pp. 24.

Reorganization of Pierce, Butler & Pierce Mfg. Corporation and Kellogg-Mackay Company.

In the filing of its charter of incorporation at Albany, September 23, the last step was taken in the reorganization of the Pierce, Butler & Pierce Mfg. Company, of Syracuse, N. Y. The new title of the company is the Pierce, Butler & Pierce Mfg. Corporation, manufacturer and jobber of heating and plumbing supplies, with branches in Worcester, Mass., Boston, New

York and Philadelphia. The new officers of the corporation are: President, J. T. Duryea; first vice-president, C. V. Kellogg; second vice-president and general manager of sales, P. M. Beecher; treasurer, J. T. Woodward; assistant treasurer, A. N. Theobald; secretary, C. F. Bennett; assistant secretary, W. M. Butler. Directors: Theodore Ahrens, Richard Garlick, M. J. Alexander, Acosta Nichols, Ralph S. Bowen, C. V. Kellogg and J. T. Duryea. The corporation will start business with a capital stock of $1,650,000, of which $700,000 is first preferred, $150,000 second preferred and $800,000 common.

The new officers of the Kellogg-Mackay Company, which filed its charter of incorporation at Springfield, Ill., Sept. 30, and which will handle the western business of the corporation, are: President, C. V. Kellogg; vice-president, J. T. Duryea; second vice-president, W. T. Woodruff; treasurer, J. T. Woodward; assistant treasurer, F. W. Fix; secretary, E. W. Payne. Directors: Theodore Ahrens, Richard Garlick; M. J. Alexander, C. V. Kellogg and J. T. Duryea. The company has a capital of $900,000, of which $500,000 is preferred and $400,000 common stock.

It is stated that the control of the two corporations will be vested in C. V. Kellogg of Chicago and J. T. Duryea of New York.

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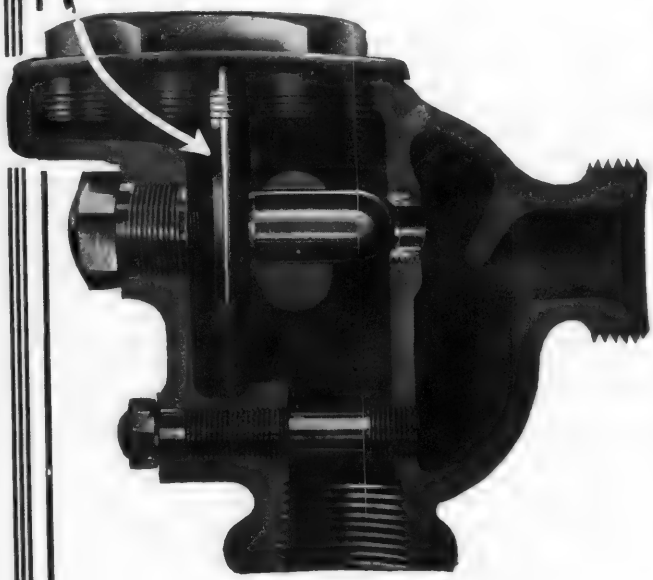
100% Efficient

This Thermostatic diaphragm dropped into the Monash Thermostatic Valve does the work



U. S. Patent, April 28, 1914

This valve has a loose thermostat which is not attached to the cover or body of the valve and **requires no adjustment.**

It has a spring bumper to take care of the over-expansion of the thermostat and prevent its collapse or rupture.

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TRADE AND MISCELLANEOUS NOTES

Coming Events.

Third Monday in Each Month—Meeting of the New York Chapter, American Society of Heating and Ventilating Engineers, Engineering Societies' Building, 29 West 39th St., New York (evening).

Second Monday in Each Month—Meeting of the Illinois Chapter, American Society of Heating and Ventilating Engineers, in Chicago (evening).

Second Tuesday in Each Month—Meeting of the Massachusetts Chapter, American Society of Heating and Ventilating Engineers, in Boston (evening).

Miscellaneous Notes.

Indianapolis, Ind.—The Public Service Commission, in an opinion written by Commissioner James L. Clark, has authorized the Crawfordsville Heating Company, of Crawfordsville, Ind., to increase its rates for heating service from 17 cents to 22 cents a square foot of radiation per season. The necessity for such action was apparent, Commissioner Clark said, when the showing was made by officials of the company that in five years' operation no return on the capital stock of the company had been paid and a deficit of $16,000 in interest due on the bonds of the company was evident. The total loss, figuring 6 per cent. a year as a reasonable return on the capital stock, reached $40,000 in the five years, the commissioner said. The capital stock of the company is $84,000 and the bonded indebtedness is the same amount, all held by local persons and all sold at par value.

Louisville, Ky.—An ordinance providing for the sale of a franchise for furnishing heat in the square bounded by Fourth and Fifth streets and Walnut and Chestnut streets, has been adopted by the lower board. The upset price of the franchise is placed at $500 and it is known as the "Seelbach franchise ordinance." Councilman Garvey, who opposed the passage of the ordinance and had it recommitted some time ago, was not at the meeting where the final action was taken. He has contended that the franchise is one of the most valuable that had been offered for sale in Louisville for a long time.

Toronto, Can.—The proposal to submit a central steam heating scheme to the vote of the people was practically set several years in the future when the mayor told the representatives of the heating syudicate that Toronto would make it a public ownership enterprise, if it was taken up at all, and that the city would not be able to finance it for several years.

Burlington, Ia.—Although a decision had been definitely reached to discontinue the central station heating system in Burlington on account of the new dam at Keokuk, a representative of the American District Steam Co., No. Tonawanda, N. Y., has been sent to investigate the reasons for the abandonment of the plant. The company's representative pointed out to the officials of the Burlington company that in spite of the 50 per cent. increase asked for heating service in order to continue the plant, this rate would be only 60 per cent. of that charged in Peoria. The ques-

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tion of finally abandoning the plant, it is stated, will await the report of the American District Steam Company's representative. In the meantime it is possible that a sufficient number of contracts can be made with merchants and office tenants to justify the continuance of the plant during the present winter, at least, especially as the season is already late for the installation of individual plants.

Cheyenne, Wyo.—The central station steam plant that is being built by the American District Steam Company, for the Natrona County Electric Company, Caspar, Wyo., is rapidly approaching completion and will be in readiness at the opening of the heating season.

Omaha, Neb.—Endorsement of the Bee Building Company's proposition to heat the City Hall has been given by the Federated Improvement Clubs of Douglas County. A resolution was unanimously adopted opposing the proposed ordinance for the expenditure of $15,000 for repairing or replacing the present City Hall heating plant. A committee was appointed to appear before the city commission and urge that the Bee Building Company's proposition be accepted.

Billings, Mont.—Two bids were received by C. O. Meyers, receiver for the Billings Mutual Heating Company, both of which were rejected. The bids were presented by P. B. Moss, of Billings, and a combination of three banks, Mahaska State Bank, Oskaloosa Savings Bank and the First Trust & Savings Bank of Billings. The Moss bid was the highest of the two, being $35,000, while the combination of banking institutions offered $34,250. In his report the receiver states that the property of the company, including the franchise, is worth $50,000.

Central Heating & Power Co., Ogden, Utah, has filed articles of incorporation, with a capital stock of $25,000, to furnish heat and power for the Dee-Eccles Estates Building and the Alhambra Theatre Building, now in course of erection, and for the Colonel Hudson Building, and, ultimately, to additional buildings. The officers are: President, R. B. Porter; vice-president, F. J. Kiesel; secretary and treasurer, Charles Ziemer. The three officers form the directorate. Others interested in the company are Albert Scowcroft and D. C. Eccles. The plant will be located at the rear of the three buildings which

25 to 50 per cent. saving in fuel

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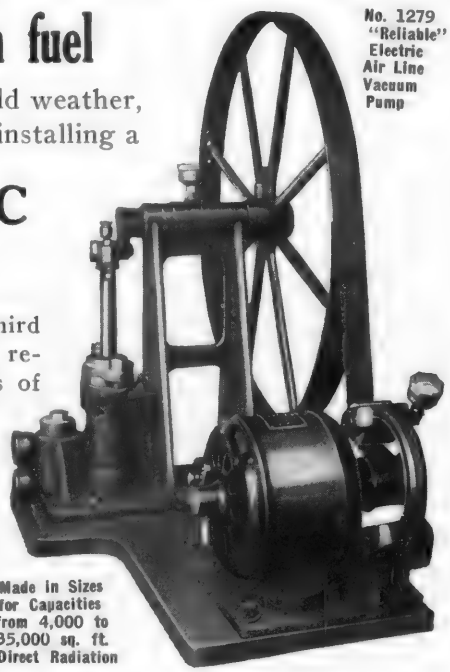

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Made in Sizes for Capacities from 4,000 to 35,000 sq. ft. Direct Radiation

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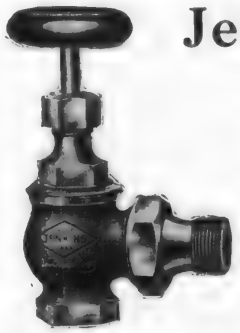
converge to a point about 150 ft. from the 24th street side of the Dee-Eccles structure.

American Boiler Manufacturers' Association, at its 26th annual convention in New York, September 1-4, 1914, decided to make an effort to increase its membership to include heating boiler manufacturers. As a result of the election the new president of the association is W. C. Connelly, of the W. C. Connelly Co., Cleveland, O.

Saginaw, Mich.—The Saginaw Heating Company, which has been constructing a central station heating plant in that city, placed its system in commission September 3, when steam was sent through the mains from the plant on Janes avenue. The plant is considered one of the most complete and best-constructed of its kind built to date. The length of its main lines totals 2,900 ft. Herbert F. Wills, president of the Saginaw Heating Company, and A. E. Duram, chief engineer of the American District Steam Company, which laid the mains in Saginaw, supervised the opening of the plant. Steam was sent through the entire 2,900 ft. of mains with a loss in pressure of 1 lb., the figures reading 20 lbs. at the power house and 19 lbs. at the end of the line.

Indianapolis, Ind.—At the conclusion of a hearing on the valuation of the plants of the Indianapolis Light and Heat Company and the Merchants Heat and Light Company, both of Indianapolis, Commissioner James L. Clark of the Public Service Commission of Indiana notified the representatives of the two concerns that they will be amenable under the law of 1913 creating the commission, for any discrimination in heating rates this winter. Commissioner Clark, as well as Corporation Counsel William A. Pickens, insisted that there should be an adjustment of rates that will place all consumers on an equal footing. The present rates are not equalized, according to officials of the Merchants' company, because the former management did not adopt any uniform rule to govern the rates. The present management, according to H. H. Harrison, general manager of the Merchants' company, has a rule for fixing heating rates based on the required radiation, but it is not yet operative in all the houses where the company supplies heat. The proposed readjustment of rates based on the cubic feet of radiation will be felt particularly by residents as far north as Sixteenth and Alabama streets, who, it is stated, have in the past been paying for less heat than they received. It is understood that the new rules will increase the company's revenues about $18,000 a year. The commission's auditors are now making a survey of the 40,000 individual contracts of the two companies and making a record of and tabulated deductions from them. When this work is completed, the commission will take up the part of the case having to do with discrimination and rates.

Indianapolis, Ind.—In connection with the hearing before the Indiana Public Service Commission on the rate question for central station heating service, it appeared



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excel because they are well designed, and made of a superior grade of new steam metal. The body, trimmings and all parts have strength and stability. They are made for satisfactory service, and guaranteed to give it.

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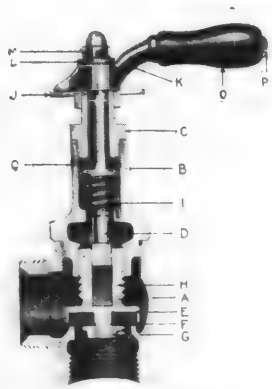
that there is a difference of $848,748 between the valuation placed on the properties of the Merchants Heat and Light Co., of Indianapolis, by the engineers in the employ of the Public Service Commission and the valuation placed on the property by the company. The present valuation of the property, as estimated by the commission's engineers, is $2,349,792, whereas the valuation placed by the company is $3,198,540. The valuation testimony for the company was given by Byron T. Gifford, of Grand Rapids, Mich., chief engineer for the American Public Utilities Company, the holding concern of the Merchants' company.

Elkhart, Ind.—It is expected that favorable action will be taken shortly on the application of the Citizens' Heating Company, through Frank Flynn and others, for a central station heating franchise for Elkhart. It is estimated that the proposed plant will cost $80,000. In the negotiations that have been conducted before the city council Mr. Flynn has submitted a proposition to pay the city 2 per cent. of the net income of the proposed heating plant at the end of the third year and, five years later, 5 per cent. of the net income annually. A schedule for charges for service has been included in the draft of the franchise, a provision being made for the metering of the service.

Manufacturers' Notes.

Illinois Engineering Co., Chicago, has moved it factory and office to 540 West Harrison Street.

Continental Heater Co., Dunkirk, N. Y., has commenced construction work on its new plant in that city. The plant is being built in the eastern part of the city on what is known as the Kimball farm, near the Lake Shore R. R tracks. This land, nine acres, was donated as a site for the new plant by Mrs. Nellie Kimball. Arrangements are being made to open Otter Street to the site of the factory, and water and electric current connections will be made. The new factory will be of brick and concrete, one story high and 400 ft. long. Its greatest width will be 96 ft. The building will have 35,000 sq. ft. of floor space. The Continental Heater Co., of which Earl C. Reed, formerly secretary of the United States Radiator Corporation, will be manager, will give employment to at least 50 men from the start. It is expected the new plant will be in operation by the latter part of February. The Company which is capitalized at $75,000, has contracts for a period



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B—Bonnet
C—Top
D—Stem
E—Disc Holder
F—Disc
G—Disc Nut
H—Disc Carrier
I —Spring
J —Dial Plate
K—Lever
L—Stem Nut
M—Stem Lock Nut
O—Wood Handle
P—Screw
Q—Stem Steam Seat

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with graduated dial and lever handle will enable you to see at the first glance the SIMPLICITY of its construction and the well proportioned body metal lines.

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ARCHITECTS, SEE SWEET'S, PAGE 1227

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Ordinary radiator valves with stuffing boxes are a constant source of damage, annoyance and expense.

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Spoiled floors, stained and discolored walls and ceilings, loose plaster, spotted decorations, furniture and rugs—these are some of the most common evidences of the use of cheap valves.

Detroit Packless Radiator Valves are absolute insurance against such troubles on all kinds of steam heating systems.

They are tight—and they always stay tight. They will not leak under any circumstances.

The installation of Detroit Packless Radiator Valves represents an investment that pays big dividends—dividends in satisfaction, in freedom from annoyance and in money saved.

Their first cost is the whole cost. They do not have to be repacked at frequent intervals at considerable expense for labor, and in large buildings there is no necessity of a man devoting a large part of his time to their care.

Detroit Packless Valves prevent the damage which comes from leaking valves and eliminate the necessity of redecorating and making repairs. They are a sure preventive of annoyance to tenant, owner and management.

And they give permanent satisfaction because they are a **good** valve and a **handsome** one.

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Ernest Wilby, Associate
Equipped with Detroit Packless Radiator Valves.

of five years, which will assure its operation with at least 50 men and will have a payroll of from $40,000 to $50,000 a year.

J. E. Whitacre Mfg. Co., Rockford, Ill., recently incorporated with capital stock of $20,000, will locate its factory at Rockford. The company will manufacture gasoline lighting plants, heating systems and galvanized sheet metal specialties.

Minneapolis Heat Regulator Co., Minneapolis, Minn., is arranging for the establishment of a branch plant in South Bend, Ind.

American Radiator Co., Chicago, makes the official statement that its domestic business up to September 1, 1914, is ahead of that for the same period last year. As yet nothing definite can be said concerning the company's foreign plants, although few of the factories are located in the war zones. In the year ended Jan. 31, 1914, American Radiator Company earnings were the largest in its history, the net profits being $2,081,267 and the amount earned on the common stock was 25.14%. The earnings of the foreign plants, which were $884,248 in the last fiscal year, are not counted in the earnings of the home company.

B. F. Sturtevant Co., Hyde Park, Mass., manufacturers of heating and ventilating fans, blowers, etc., is planning the erection of a branch manufacturing plant in Seattle, Wash., to cost between $35,000 and $50,000, which will employ fifty men. The factory at San Francisco is the only one now operated by the company on the Pacific coast. Ralph Chatham, manager of the company's Seattle branch, reports that business in the Pacific northwest is growing so rapidly that ultimately Seattle may become the headquarters for the entire coast. The site of the new plant has not yet been selected, but the building will be of concrete, 100x200 ft.

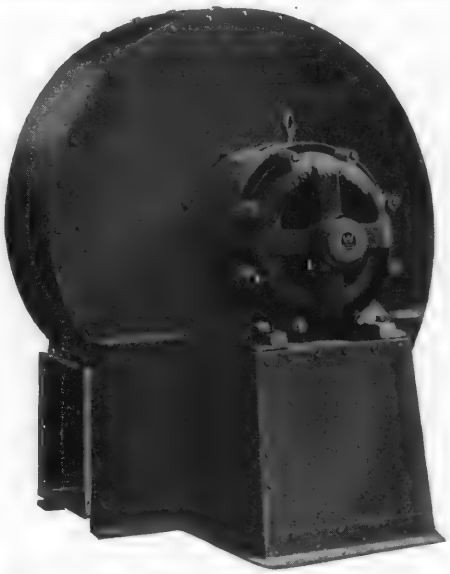
United States Radiator Corporation, Detroit, Mich., announces the removal of its Boston branch to new quarters at 136 Federal Street, Boston.

New Firms and Business Changes.

W. C. Gibson & Co., Louisville, Ky., is a new heating contracting firm, organized by W. C. Gibson, until recently a member of the firm of James McWilliams & Co.

Western Heating, Plumbing & Construction Co., Aberdeen, Wash., has reduced its capital stock to $9,000.

Acme Plumbing & Heating Co., Winnetka, Ill., is the new name of the Winnetka Plumbing and Heating Co., of that place. The company has also increased its capital stock from $2,500 to $10,000.



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To insure reliable and economical operation, specify

Westinghouse Electric Motors

for driving ventilating fans and blowers.

A complete line of alternating and direct-current motors especially designed for ventilating service.

Quiet in operation.
Compact in design.
Require practically no attention.
Do not drip oil.
Very economical in the use of current.
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In Times of War

the fate of a nation may depend on the satisfactory operation of the machinery. Naval authorities choose only apparatus that is tried, tested and proven—apparatus that runs without the necessity of constant attention—apparatus that will not break down at the critical moment.

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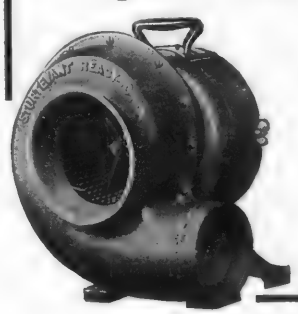
Fans and Forced Draft Equipments

supply this super-dreadnaught with air. Forced draft fans supply 480,000 cu. ft. of air per minute. Should any of these fans fail, the steaming power and consequently the speed of the ship would be greatly reduced. Dependable apparatus is essential. That's why it's Sturtevant.

Besides Forced Draft this ship has over 80 Sturtevant Ventilating Fans and over 20 Ready-to-Run Portable Ventilating Sets for supplying air to cabins and smaller rooms.



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AND ALL PRINCIPAL CITIES OF THE WORLD

Phillips, were formerly employed by the Keithly Company. The company has opened quarters at 609 San Jacinto Street.

New Corporations.

Amo Light, Heat & Power Co., Amo, Ind.; capital, $3,000. Incorporators: W. W. Cosner, J. E. Hodson and E. L. Fusen.

Indiana Steam Heating & Plumbing Co., Indianapolis, Ind.; capital, $3,000. Directors: M. M. Hill, A. L. Pauley and R. H. McCormick.

Alamo Heater Co., Chicago; capital, $10,000, to manufacture and deal in heating apparatus and supplies. Incorporators: Charles Smith, George L. Richards and Olive L. Richards.

Southern Heating & Plumbing Co., Houston, Tex.; capital, $4,000. Incorporators: L. G. Smith, T. W. Walker and Robert E. Goree.

Acme Moistener & Mfg. Co., Chicago; capital, $2,500; to manufacture and sell humidifying apparatus for use with steam radiators, etc. Incorporators: Delmar C., Ida R. and Helen J. Lyon.

Southern Plumbing & Heating Co., Austin, Tex.; capital, $4,000. Incorporators: G. Smith, T. W. Walker and Robert E. Goree.

Zuber Mfg. Co., St. Louis, Mo.; capital, $25,000; to manufacture heating and plumbing specialties. Incorporators: Gottlieb Zuber, Frederick Girtanner and Alexander Girtanner.

Spiro & Merrill Heating and Roofing Co., Birmingham, Ala.; capital, $7,000. President, Lee Merrill; vice-president, N. J. Merrill; secretary and treasurer, S. Spiro.

Green Heating & Plumbing Co., Salt Lake City, Utah; capital, $50,000. Incorporators: Henry Green, M. Thomas and William Green.

Welshans Heating Co., Ogden City, Utah; capital, $1,800; to deal in heating specialties. President, Byron Naisbitt; secretary, Joseph L. Welshans; treasurer, G. B. Welshans.

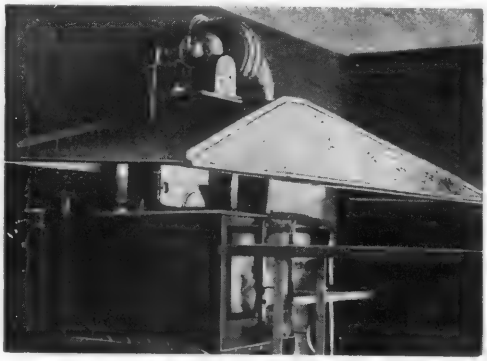
Contracts Awarded.

Kinnison Bros., Dallas, Tex., heating and ventilating Hogg School, in Dallas, for $3,467; and Brown School, Dallas, for $2,040.

Hamilton & Co., Dallas, Tex., heating and ventilating Bowie School, Dallas, for $6,275; and Houston School, Dallas, for $5,947.

J. W. Frye & Son, Lake Forest, Ill., heating and lighting new Lake County General Hospital at Waukegan.

Cleghorn Co., Boston, Mass, heating new



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Multi-Blade Ventilating Fans

Can be used to great advantage in connection with cooling and exhausting odors from kitchen, smoke from club rooms, ventilating toilet and bath rooms.

They deliver twice the amount of air as the ordinary steel plate fan, hence require only **one-half** the space for the same duty.

Sirocco Multi-Blade Fans operate quietly and require **less power** to deliver the same amount of air when compared to the ordinary steel plate fan twice the diameter. They are easy to install and are nicely adapted to sheet metal work.

Our Discounts to Dealers, Contractors, and Sheet Metal Workers are attractive. Ask us about them.

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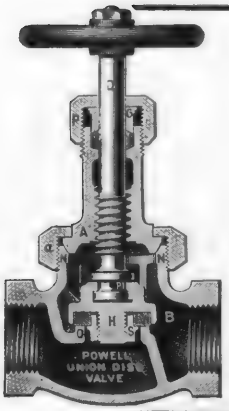

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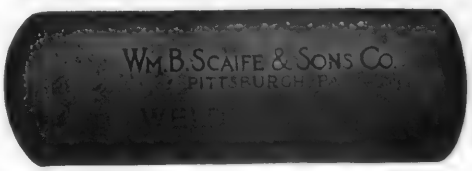

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Park Building, at Main and Franklin streets, Worcester. The heating plant will also supply heat for the new building of the Worcester Trust Co. W. G. Cornel Co., New York, has the plumbing contract.

Bryce Heating and Ventilating Co., Toledo, Ohio, heating and ventilating high school at Kokomo, Ind., for $17,000; and heating and plumbing high school at Granville, Ohio, for $10,000; also heating and ventilating new Dime Savings Bank Building, at Superior and Adams streets, for $16,000.

Larsen & Wood, Toledo, Ohio, heating and plumbing new building of the Roberts-Toledo Auto Co., for $4,000; also plumbing new Dime Savings Bank Building in Toledo.

Providence, R. I.—Bids were received as follows for the heating of the new children's ward at the Rhode Island State sanitarium at Wallum Lake; Rhode Island Supply and Engineering Co., Providence, $2,131; General Fire Extinguisher Co., Providence, $2,300; Power Heating and Ventilating Co., Boston, $2,301; Isaac Coffin Co., Boston, $2,584; Peter B. Mulvey Plumbing Co., Woonsocket, $2,793; McCaffrey Heating Co., Pawtucket, $2,900.

Reardon Bros. & Co., Lynn, Mass., heating and plumbing new Blossom Street School, in Lynn.

Milner Bill Co., Springfield, Mass., power piping, heating and sprinkler systems for the Pratt-Read Co.'s new factory at Deep River, Conn.

Hateley & Hateley, Sacramento, Cal., heating new $100,000 Hotel Lodi, at Lodi. The plumbing contract went to Henderson Bros., of Lodi.

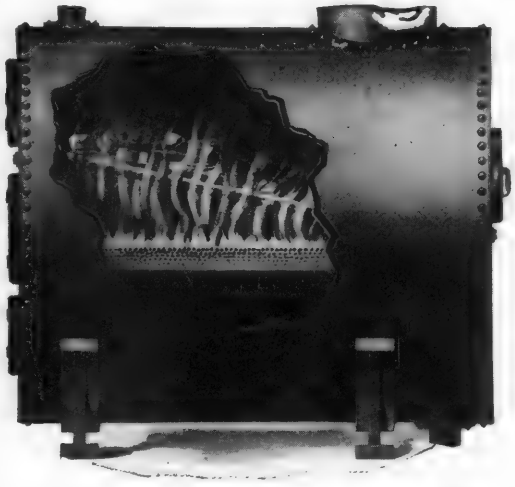
Caldwell & Semple Co., Sharon, Pa., heating and plumbing new Odd Fellows' Temple at Hubbard; also remodeling steam heating system at Westminster College and installing vacuum cleaning system.

F. S. Schardein & Sons, Louisville, Ky., heating and ventilating new school building at Cypress and A streets, Louisville, for $12,637.

Gillis & Geoghegan, New York, steam heating new $450,000 office building at Fifth avenue and Thirty-seventh street, New York.

Finnegan Bros., Portland, Ore., heating store building at Fourth and Salmon streets, Portland, for A. & C. Feldenheimer

You kill two birds with one stone



When you install a

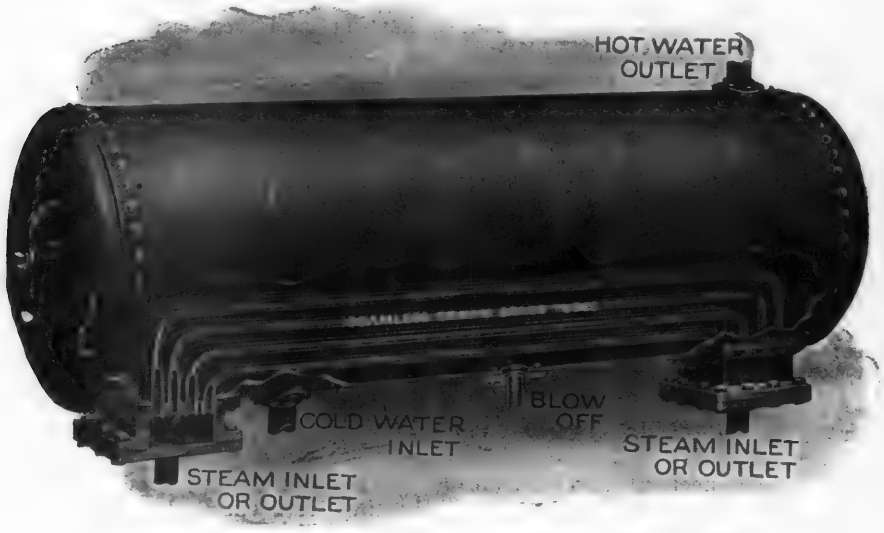
Sims Water Heater and Garbage Burner

You dispose of your garbage and you transform it into fuel.

No troublesome features. They have all been taken care of. No offensive odors, no nuisance, unburnable refuse easily removed, tubes readily cleaned. Heating capacities from 150 to 3,200 gals. water per hour.

Full particulars in Bulletin H-G. B., No. 3. Send for it.

THE SIMS COMPANY, 18th Street, Erie, Pa.



Patented Aug. 26, 1913

TYPE C

THERE IS NO IDLE HEATING SURFACE

IN THE

PATTERSON
HOT WATER TANK

for heating water for domestic or manufacturing purposes

When steam enters the **Expansion Chamber,** it expands and uniformly fills the tubes, whose combined cross-sectional area is several times that of the steam pipe. As rapidly as the steam condenses, due to transmitting its heat to the surrounding water, it is discharged into the **Condensation Chamber.**

The Condensation Chamber has sufficient area to provide for any sudden increase of condensation without permitting it to back up into the tubes to destroy their heating efficiency.

The heating surface in the Patterson Tank consists of a number of parallel seamless drawn brass tubes, both ends of each being expanded into heavy cast iron tube-heads with an improved roller expander. Their ∩ shape provides for the free contraction and expansion of each individual tube without straining, so there is no danger of leakage.

Any combination of storage and heating capacities can be furnished.

FRANK PATTERSON & CO.

26 CORTLANDT STREET, NEW YORK

Representatives in All Principal Cities

Please mention THE HEATING AND VENTILATING MAGAZINE *when you write.*

James W. Partlan, Detroit, Mich., heating, ventilating and plumbing new Fairbanks School, in Detroit, for $14,165.

A. W. Schultz & Co., Detroit, Mich., heating, ventilating and plumbing new school building, on Sylvester avenue, Detroit, for $14,792.

Raisler Heating Co., New York, heating six-story apartment building at Cathedral Parkway and Seventh avenue, New York.

L. E. Smith Co., Gloucester, Mass., heating and plumbing new St. Ann's parochial school at Gloucester, for $3,543. Other bids were: L. E. Andrews, $3,600; Frank Regan, $4,246, and O. J. Biggs & Co., $3,985.

Hopson & Chapin Mfg. Co., New London, Conn., heating first group of buildings for the Connecticut College for Women, for $25,000.

Barker Bros. Co., Newport, R. I., heating and ventilating Calvert School Building, in Newport, for $2,075. Other bids were: Thomas B. Connolly, $2,497; H. C. Lawton, $3,739.

Fred T. Ley & Co., Springfield, Mass., installing new power plant at the Young Men's Christian Association College in Springfield.

M. D. Holmes & Sons, Worcester, Mass., heating and ventilating Freeland Street School, Worcester, for $9,685.

Paul Shean Plumbing Co., Galveston, Tex., installing two additional boilers and remodeling heating system in the John Sealy Hospital at Galveston, for $56,000.

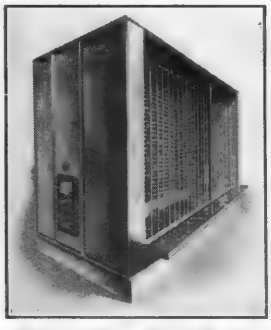
Warnock & Zahrndt, Rochester, N. Y., heating and ventilating new No. 26 School, on Bernard street, Rochester, for $23,000. The plumbing contract went to Barr & Creelman, Rochester, at their bid of $4,596.

Jennison Co., Fitchburg, Mass., heating system for the $500,000 extension of the Putnam Machine Co., at Fitchburg. The sprinkler system contract went to G. M. Parks & Co., and the plumbing contract to W. P. Kirk Co., Bridgeport, Conn.

H. C. Worcester, Roodhouse, Ill., steam heating and ventilating new Washington School in Roodhouse, for $2,684.

City Heating and Plumbing Co., Boulder, Col., heating and plumbing County Court House Building at Boulder, for $4,320.

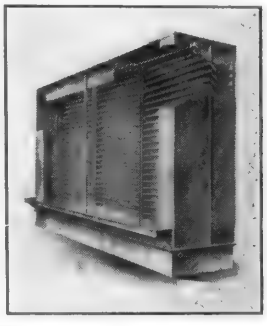
Fitzpatrick & Hoepfner, Columbus, O., heating and plumbing Central Building and Loan Association Building, at 45 East Gay street, Columbus.



Webster "Type A" Air Washer

WEBSTER Air Conditioning APPARATUS

is designed and built to meet the individual requirements of each installation.



Webster "Standard" Air Washer

NO ONE TYPE of apparatus is best suited for all kinds of service, but for each condition such as Air Cleansing, Air Cooling, Humidifying, etc., there is a type of Webster Air Conditioning Apparatus that is most effective for the specific service.

For this reason more satisfactory results can be secured than is possible with a type that has been designed in an attempt to meet all conditions.

While Webster Air Conditioning Apparatus is made in several types, each type is of the same high class design—constructed of the same high class material and workmanship—a standard that is always maintained.

Consult us before writing your next specification.

WARREN WEBSTER & COMPANY, CAMDEN, N. J.

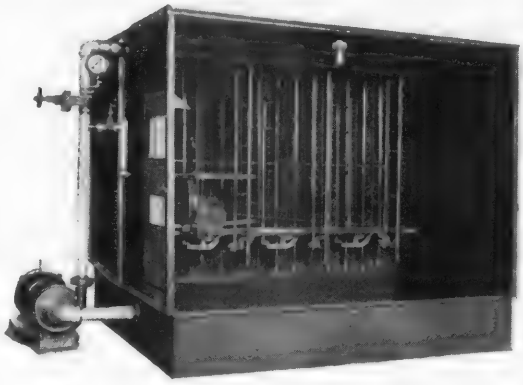
Established 1888 **24 Branch Offices**

Please mention THE HEATING AND VENTILATING MAGAZINE *when you write.*

OVER 30,000,000

Cubic Feet of Air Each Minute Passes Through

ACME AIR WASHERS AND HUMIDIFIERS



Over 60,000 "Acme" spray heads can be automatically flushed four times per hour. Have you investigated Air Washers or let some salesman tell you about them? Go out and investigate the "Acme." You will find one in your city—either in the bank—theatre — department store — office building—school—or factory—possibly it is equipped with automatic humidity control, as a large number of them are. If not we will tell you how we do it.

Send for "Acme" Bulletin.

IROQUOIS ENGINEERING CO., Manufacturers CHICAGO -:- ILL.

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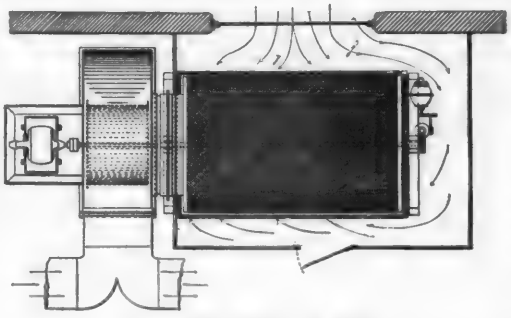
SIMPLICITY IN AN AIR WASHER



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Plan

This Is the Outstanding Feature of

The KINGWELTON Rotary Air Purifiers

Note the revolving drum, encased with an imported fabric of suitable mesh and weave, which revolves through a water bath, at any desired speed. The air passes through the mesh into the interior of the drum, and thence to the blower.

HUMIDITY REGULATED BY SPEED OF WASHER

99% of impurities removed, by test. 1 H.P. per 50,000 cu. ft. of air per minute.

This apparatus is manufactured at our own works in sizes to suit conditions. Plans furnished for ventilating plants, with air purifier combined.

A FEW INSTALLATIONS.

NEW YORK CITY.	OTHER CITIES.
Singer Building.	Pennsylvania Depot, Union Station, Pittsburgh, Pa.
National Park Bank.	Pennsylvania Depot, Union Station, Washington, D. C.
Breslin Hotel	American Mfg. Co., Greenpoint, L. I.
Flat Iron Restaurant.	Independent Order of Foresters, Canada.
Residence of Mr. A. G. Jennings.	People's Gas. Co. Building, Chicago, Ill.

Write for descriptive Circular.

WELLS AND NEWTON COMPANY

Avenue B & 17th Street, New York City

Kendall Heating Co., Portland, Ore., heating plant for the University of Oregon.

Peck Bros., Montpelier, Vt., heating and plumbing, Barre City Hall.

W. W. Sibley & Co., South Bend, Ind., heating and plumbing new La Salle Theatre, in South Bend; also heating and plumbing hospital building for the Orphans' Home at Mishawaka, Ind.

William M. Anderson, Sansom street, Philadelphia, heating and plumbing new Hotel Traymore, in Atlantic City. This building will contain 700 rooms, with baths.

Standard Engineering Co., Washington, D. C., heating and plumbing new office building for the United States Department of Agriculture, at Fourteenth and B streets, S. W., Washington.

M. D. Holmes & Son, Worcester, Mass., heating and ventilating Freeland Street School, Worcester, for $9,685; also heating and ventilating Canterbury Street School, Worcester, for $2,695.

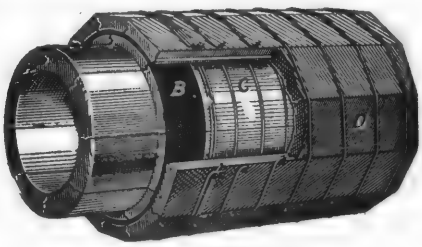
Fresno, Cal.—Bids were received as follows for the heating and ventilating of the new Columbia School at Fresno: Pacific Blower Co., $4,185, $3,785 and $3,285; Scott Co., San Francisco, $3,456; Robert Dalziel, Jr., $3,497; Griffin Co., $3,675, Kuttner-Goldstein Co., $3,703. Barrett & Shields, $3,920; O'Mara & Co. $3,992; Pacific Fire Extinguisher Co., $4,400.

T. N. Barr Plumbing & Heating Co., Salem, Ore., heating new Court House in Salem, for $2,148. Other bidders were: E. J. Page, $2,134; Spinning & Cornell Co., $2,468; Fraser & Pratt, $2,480; Appling-Griggs Co., $2,288; Pacific Heating & Engine Co., $1,830; W. G. McPherson Co., $2,550.

Business Troubles.

Isaac A. Sheppard & Co., Philadelphia, Pa., manufacturers of stoves, ranges, heaters, etc., with a large plant in Philadelphia, has been placed in the hands of a receiver. The failure is said to be due to the European war and the consequent tying up of assets. The assets of the company are fixed at $1,000,000 and the liabilities at $500,000. The petition in bankruptcy was filed by the Niagara Radiator and Boiler Company, North Tonawanda, N. Y., with a claim of $4,855. It is said that the firm owes large sums of money to banks and others on promissory notes and that by reason of the extraordinary financial conditions brought about by the European war the company is unable to obtain prompt payment of its outstanding bills.

Willard E. Lape, Utica, N. Y., heating and plumbing contractor, has filed sched-



A—Inner Shell, 2 inches thick.
B—Asphaltum Packing.
C—Dead Air Space.
D—Outer Shell, 1 inch thick.

Cover Your Steam Pipes

WITH WYCKOFF'S IMPROVED

CYPRESS COVERING

Made of Gulf Cypress, the wood eternal

Not affected by wet and dry conditions common to steampipe trenches. Will not rot. Lasts twice as long as Pine Casing. Absolutely water and steam tight. Each shell is wound with heavy galvanized wire. Coated all over with the best known preservative—Hydrolene B.

Let us answer your questions and tell you all about it. Booklet on request.

A. WYCKOFF & SON COMPANY

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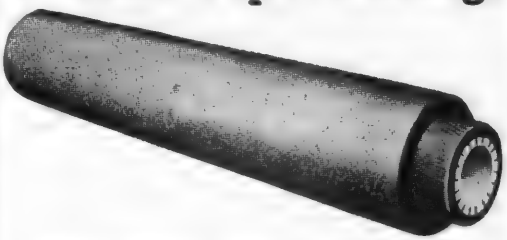
STANDARD
Steam Pipe Casing



Above cut illustrates the completion of our tin lined

STEAM PIPE CASING

We also make unlined casing.

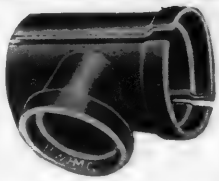
FOR

Insulating Underground Steam Pipes

Write for CATALOG and PRICES.
We furnish all SPECIALS required.

Standard Wood Pipe Co.
Williamsport, Penna.

One Big Heating Plant Costs Less to Operate



than a dozen little ones.

Factories, colleges, etc., that have a small heating plant for each building can often save thousands of dollars by installing one central heating system and conveying steam pipes through J-M Sectional Conduit to all buildings.

This is high class work that brings you big profits and adds to your reputation.

J-M SECTIONAL CONDUIT

carries steam thousands of feet with practically no radiation or condensation.

It lasts indefinitely because made of special tile, salt glazed inside and out. Not affected by acids, oils, fire or the action of the earth. Readily removed and replaced.

Write nearest Branch for Catalog No. 112

H. W. JOHNS-MANVILLE CO.

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Boiler Copings and Foundation Caps for Motors, Pumps, Fans and Blowers

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Dixon's Graphite
PIPE JOINT COMPOUND

Resists heat, cold, acids, alkalis, chemicals, salts of all kinds—a perfect preventive of corrosion.

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Made in JERSEY CITY, N. J., by the

Joseph Dixon Crucible Co.

Established 1827

Multiple Roller Expansion Bearings

one of the many Exclusive Features of
Ric-wiL MethoD of Insulating Underground Pipes

Malleable iron guide with pockets which support a steel spindle, on which **Brass Rollers —Rust Proof**—are always free to turn. Lugs are provided which penetrate the **Diatomite** Insulation which is **Integral** with the vitrified conduit to insure against any lateral movement of the bearing.

Catalog explaining our many other features yours on request.

The Ric-wiL Underground Pipe Covering Co.
623 NEW ENGLAND BUILDING, CLEVELAND, O.

ules in bankruptcy, in which it is shown that there are prior claims amounting to $11,910. These claims are prior through liens filed against his contract for heating the Watertown Y. M. C. A. The principal claim is that of John Weeks & Co., for $10,511. Among the unsecured claims, which total $7,490, are those of Jessie B. Lape, $3,435; Direct Separator Co., $135; John Weeks & Son, $1,222. The total liabilities are $22,025 and the assets $17,239.

Business Chances.

Washington, D. C.—Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, for the following-named work:

Until Oct. 13, 1914, for the construction, including mechanical equipment, etc., of the U. S. Post office building at Shelbyville, Tenn. One story, basement and mezzanine, 3,600 sq. ft. ground area.

Until Oct. 14, 1914, for the construction complete, including mechanical equipment, etc., of the U. S. Post Office at Jellico, Tenn. Two stories and basement, 4,000 sq. ft. ground area.

Until Oct. 19, 1914, for the construction complete, including mechanical equipment, of the U. S. Post Office at Portland, Ind. One story and basement, 4,350 sq. ft. ground area.

Until Oct. 27, 1914, for the construction complete, including mechanical equipment, of the U. S. Post Office at Carnegie, Pa. One story and basement, 3,565 sq. ft. ground area.

Until Nov. 4, 1914, for the construction complete, including mechanical equipment, etc., of the U. S. Post Office at Stamford, Conn. One story and basement, 11,000 sq. ft. ground area.

Until Nov. 4, 1914, for the construction complete, including mechanical equipment, of the U. S. Post Office at Danbury, Conn. Two stories and basement, 8,630 sq. ft. ground area.

Until Nov. 5, 1914, for the construction complete, including mechanical equipment, etc., of the U. S. Post Office at Princeton, Ill. Two stories and basement, 4,970 sq. ft. ground area.

Until Nov. 6, 1914, for the construction complete, including mechanical equipment, etc., of the U. S. Post Office at Collinsville, Ill. Two stories and basement, 4,970 sq. ft. ground area.

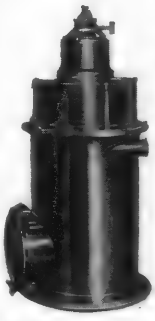
Trade Literature.

KAUFFMANN RADIATOR SHIELDS, made in various plain and ornamental designs for different types of radiators, are treated in a catalogue received from the Kauffman Engineering Co., St. Louis, Mo. Many reasons are given why the Kauffman dustless radiator shields should be used, such as the prevention of dirt particles on the walls immediately above the radiator, the protection of the finish on woodwork, etc. Emphasis is laid on the point that the Kauffman shields positively catch and retain the dust circulated by radiators. Special forms of shields are shown such as utility shields with flat marble or glass tops. A price list is included, covering each size and type. Size 6x9 in. (standard). Pp. 20 (punched for binding).

SIMS WATER HEATER, REFUSE AND GARBAGE BURNERS, shown and described in catalogue issued by the Sims Co., Erie, Pa., include both horizontal and vertical types. In this heater the garbage grate is formed by a row of 1½-in. charcoal iron tubes placed on an incline to facilitate circulation. The tubes are expanded into each head of the inner shell and are connected thence with the water space. The heaters are especially designed for the disposal of mixed garbage, hospital refuse and other accumulated rubbish. By the rapid evaporation of the moisture the waste matter is converted into a combustible condition and is consumed, thus assisting in the heating of water for any purpose. Special provision is made in the construction of the heater to prevent offensive odors from escaping into the room. It is also mentioned that the garbage grate is so constructed that no matter how much refuse is placed upon it, the draft is not interfered with, so that all gases and odors pass freely to the chimney. A door is provided at the rear for the removal of such refuse as cannot be consumed. Also plugged holes are located in the outer shell, opposite each tube. By removing the plugs, the tubes may be scraped whenever necessary. This type of heater is made in eleven different sizes, with heating capacities in gallons of water per hour, from 150 to 3,200. The heater is of high-grade boiler construction, and being a cylindrical structure, consisting of an inner and outer shell, with water space between, stay braces are only required in the heads. This, it is stated, allows free and rapid circulation of the water and also eliminates to an extent the formation of scale. Size 6x9 in. (standard). Pp. 8.

FOXBORO LIQUID LEVEL GAUGES AND FOXBORO IMPROVED RECORDING GAUGES are the subjects of two new catalogues (Bulletin No. 82 and Bulletin No. 88, respectively), published by the Industrial Instrument Co., Foxboro, Mass. In the bulletin devoted to the liquid level guage, which is used among other things, for measuring head of water and levels in open tanks and reservoirs, rivers, camels, sewers, tide levels, etc., several interesting records are reproduced showing the results of several dif-

ferent applications as used in practice. The illustrations indicate how the Foxboro patented pressure tube movement is especially adapted for liquid level recorder service. In the recording guage bulletin, both the improved helical tube movement and the improved diaphragm tube movement are shown in detail, besides a number of other new features. A variety of charts are shown, some of which containing the records as made in service. A complete list of ranges between full vacuum and 10,000 lbs. per square inch are conveniently tabulated, priced and given code words. Size of each catalogue 8x11 in. Pp. (No. 82) 20; (No. 88) 32.



H.P.Equipment

Spencer Turbine Vacuum Cleaners

are manufactured in sizes from ¾ H. P. to 40 H. P.

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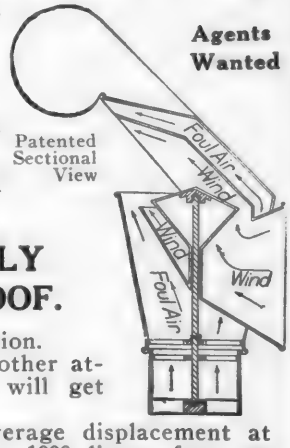
SPENCER TURBINE CLEANER COMPANY

HARTFORD, CT.

American Standard Automatic Air Pump

Having a Special NO-DOWN-DRAFT feature, it insures a steady upward pull at all times.



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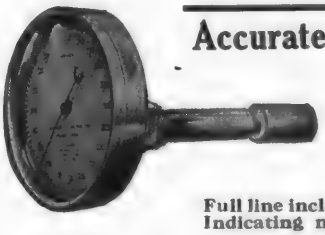
Agents Wanted

ABSOLUTELY STORM PROOF.

Needs no attention. Has no fans or other attachments that will get out of order. Will give an average displacement at the rate of over 1000 linear feet per minute.

Specified by the New York and Massachusetts Boards of Education.

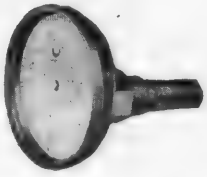
Century Ventilating Co.,
73 Guernsey St., Brooklyn, N. Y.



Accurate Service Is Assured When You Use

Standard Indicating and Recording Thermometers

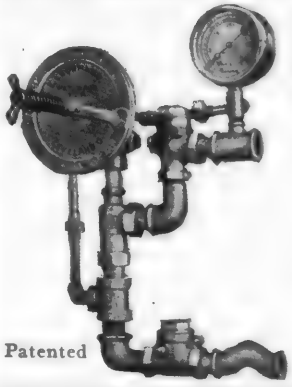
Guaranteed Correct



Full line includes seven types of recording thermometers and a special line for mechanical uses. Indicating mechanical thermometers are furnished with extensions from 2 to 30 in. in length.

All thermometers are double and not breakable.

STANDARD THERMOMETER COMPANY Clinton and Shirley Streets **BOSTON, MASS.**



Patented

Leonhard Automatic Water Driven Air Exhauster for Maintaining a Vacuum in Heating Systems

This simple and durable device has proven very satisfactory wherever used in connection with steam heating plants having an air line or drip pipe system connecting all the radiator air valves. There is nothing made that is as well adapted for the service. It is the same as having a double check and seal on the end of air discharge line for the purpose of holding the natural vacuum that forms when steam dies down, but with Automatic Ejector intermediate, so that when desired air may be mechanically removed from the radiators and thorough circulation of steam started quickly. This is desirable early in the morning when starting the system, while in severe weather a continual vacuum maintained automatically on the heating system assures the greatest results obtainable from steam. For further particulars address

FREDERICK LEONHARD

536 East 123d Street, **CLEVELAND, OHIO**

The First Authoritative Handbook on District Heating

CENTRAL STATION HEATING

BY

BYRON T. GIFFORD

MEMBER AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS,
JUNIOR MEMBER AMERICAN SOCIETY OF MECHANICAL ENGINEERS

208 Pages, with 42 Figures, including 50 Pages of Miscellaneous Engineering Data

Size 6 x 9½ in., Bound in Flexible Leather

Now Ready for Delivery ***By Mail, Postpaid, $4.00***

CHAPTER I—IN GENERAL

Unit of Measure. Advantages of Central Station Heating.

CHAPTER II—PIPE LINE LOSSES

Loss from Radiation. Table of Square Feet of Surface in Pipe. Table of Unit Radiation Loss. Efficiency of Underground Covering. Loss from Leaks. Loss from Friction. Loss from Both Friction and Radiation. Pipe Capacity Tables. Value of Good Insulation.

CHAPTER III—PIPE LINE DESIGN IN GENERAL

Hot Water System. Steam System. Steam System (Return). Percentage of Line Loss. Map of One-Pipe Steam System. Map of Two-Pipe Steam System. Map of Multiple Water System. Map of Belt Water System. Comparison of Systems. Tunnel and Conduit Construction. Notes on Construction. Notes on Repaving.

CHAPTER IV—RATES IN GENERAL

Temperature Control. Heat Consumption Tables. Heat Pro-Rating Table. Maximum Demand Rate. Fixed Charges; Operating Costs.

CHAPTER V—THE HEATING STATION

Steam Systems. Water Systems. Boilers. Pumps. Reheaters.

CHAPTER VI—OPERATION AND MAINTENANCE

Pressure Required in Heating Mains. Pressure Required in Hot Water Mains. Regulating Flow of Water. Temperature Required in Hot Water Heating Mains. Schedule of Temperatures. Notes on Maintenance. Pipe Line. Station. Traps, Meters, etc. Percentage of First Cost.

CHAPTER VII—MANAGEMENT

Notes in General. New Business Department.

CHAPTER VIII—FRANCHISES

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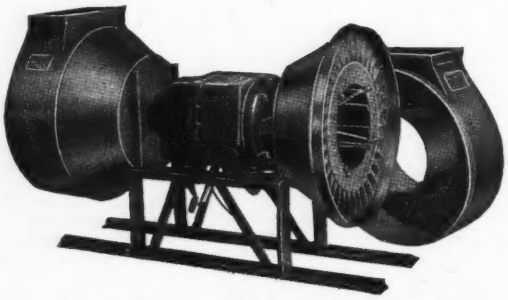

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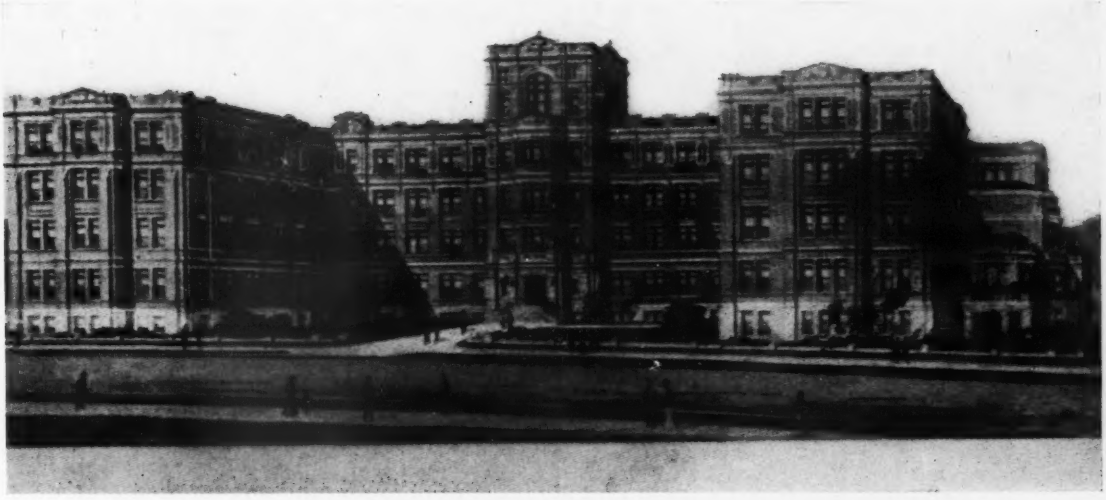

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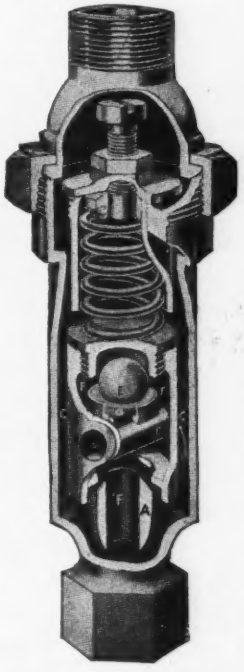

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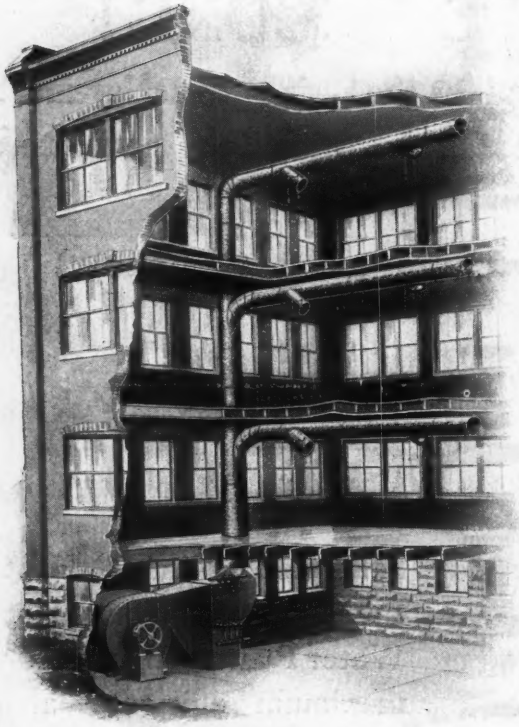

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